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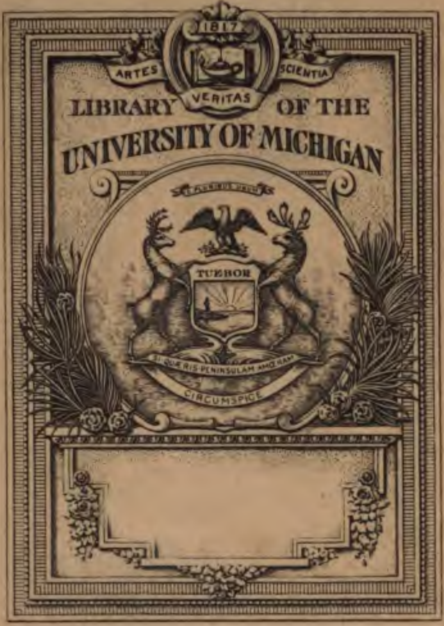

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EVENING AMUSEMENTS;

OR, THE

BEAUTY OF THE HEAVENS *DISPLAYED.*

IN WHICH

SEVERAL STRIKING APPEARANCES,

TO BE OBSERVED ON VARIOUS EVENINGS IN THE

HEAVENS,

DURING THE YEAR

1813,

ARE DESCRIBED.

TO BE CONTINUED ANNUALLY.

BY WILLIAM FREND, ESQ. M.A.

ACTUARY TO THE ROCK LIFE ASSURANCE COMPANY, AND LATE FELLOW
OF JESUS COLLEGE, CAMBRIDGE; AUTHOR OF PRINCIPLES
OF ALGEBRA, TANGIBLE ARITHMETIC, ESSAY
ON PATRIOTISM, ETC.

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In following the plan of the preceding volumes of this work, by giving a detail of the appearances of each month, and prefacing it with remarks on some general subject, one of great importance has been chosen for this year; as might have been expected from the Appendix to the last year's volume. To do full justice to such a question, would require more room than could be allowed in so small a work; but enough is said to excite enquiry: and, by fixing the attention of young people on some easy experiments, they may be gradually led to exercise their judgement, instead of taking upon trust the conjectures of a preceding age. It is not necessary to be positive on either side; but the author may state, that every research of his carries him farther from the received doctrine of attraction; and leads him to conceive, that the motions of the planets are produced by a cause of an opposite nature; namely, by impulse. How that impulse is produced, is a question that may exercise the sagacity of many a future age: and the discoveries that are daily making on substances within our reach, together with the improved observations on the motions of the heavenly bodies, will enable us to build our knowledge upon surer foundations.

EVENING AMUSEMENTS;

OR, THE

BEAUTY OF THE HEAVENS

DISPLAYED.

TO THE READER.

IN my last year's volume I introduced a few thoughts on the subject of Attraction, the great cause, as it has been supposed, of the heavenly bodies being retained in their orbits. I have ventured to call in question the existence of such a law, and am by no means surprised, that my doubts should not have obtained a general reception. The question has its difficulties on all sides; and, when we consider the various opinions that have been held in different ages of the world, and the manner in which each has been driven out by its successer, we shall not be surprised at the length of time in which they have prevailed, and with what unbecoming asperity some were maintained. How opposite are modern from antient sentiments! What a contrast there is in the belief, that the heavenly bodies are fixed in a hard, crystalline substance, and the present belief, that the planets wander in pure space, attracting and attracted by each other, and that every particle of matter is endued with a power, acting to an indefinite extent!

The first opinions on the heavenly bodies would naturally be crude, and founded upon the manner in which the objects strike the senses. On a clear day, the sun is perceived to rise in the morning, and to set at night. His splendour eclipses that of every other object in the heavens, and there appears nothing in them by which to compare his daily motion in the ecliptick. At night, the stars strike the senses as an assemblage of sparkling objects, arrayed in no order, and distinguished by different degrees of splendour. A considerable time must have elapsed before they were formed into constellations, and, during much of that interval, no distinction would be made between stars and planets. What was more natural than to imagine them all fixed in a solid orb, and that this orb should revolve around the earth? What could induce men to suppose, that the earth, which offered not to the senses the least appearance of motion, should, in reality, be the cause of the apparent diurnal motions of the heavenly bodies?

To the opinions they formed, appropriate language would be adapted. The heavens would be spoken of as a firmament; and, by this word, or a term similar to it in the Greek, the sphere around us would be denoted. A term once used would spread the opinion still farther, and impress it more deeply on the mind; and, if any thing sacred was attached to it, the difficulty of removing such an impression would be increased. The translators of our scriptures adopted this term from the Latin, who derived theirs from the opinion of the Greeks; and hence we read, in the first chapter of our Bibles: "Let there be a firmament in the midst of the waters: and God made the firmament, and called the firmament Heaven." In another place, speaking of the sun and moon, it is said: "God set them in the firmament of the heavens, to give light on the earth."

For many, many centuries, this opinion held its ground. Difficulties would continually rise up, but the philosophers, not able to get rid of their first impressions, endeavoured to solve them by a variety of contrivances, which served for a short time, but led to so many other inconveniences, that their systems grew at last insupportable; and all their cycles and epicycles vanished, on the simple plan of ascribing two motions to the earth,—one diurnal, around its axis, and the other annual, around the sun, in an orbit said to be elliptical.

To us, who have been brought up in the knowledge of these two motions, the errours of our ancesters seem to be unaccountable. We are astonished at their obstinacy in not embracing sooner the truer system, when proposed to them; at their clinging to an opinion, which now appears so entirely destitute of foundation. But first impressions are not so easily overcome. What has been long taught is approached with reverential awe; and, in this case, there appeared to be a contradiction between the dictates of philosophy, and the precepts of religion. Had this been really the case, had revelation interfered to establish a doctrine, its supporters would have been fully justified in their pertinacity: but the hundred arguments from scripture, published by a learned theologian, against the motion of the earth, slumber quietly on the shelves of a few libraries; and it is now acknowledged, that the bible has a more important end in view, than that of rectifying our mistakes in natural philosophy.

But it is singular, that they, who laid so much stress on the scriptures, did not take due pains in enquiring what foundation they gave for the solid matter of the firmament. Had they done this, they would have found that their own false notions were fathered upon the scriptures, merely from want of attention to the meaning of words. When they were translated into Greek, the opinion prevailed of a solid firmament, and the translaters thought themselves justified in giving that meaning to a Hebrew word, which, in their opinion, best suited the passage. God made the firmament, was to them the meaning intended by the writer of the first chapter of Genesis, to ~~whom, however,~~ no such opinion can be attributed. For all that he says is; that God made the expanse, or, in other words, our sphere of air, a body by no means possessing the solidity of the philosophical firmament. The philosophers, however, of those, and the divines of later days, were very little acquainted with the Hebrew language; and, when the world became Christian, the term firmament had gotten possession, and its correspondence with the original was not called in question.

It is pleasing to observe, how the Greeks, who boasted of all wisdom, were thus overcome by the Jews, whom they despised. Whilst the former, wandering in all the mazes of what they called philosophy, were entertaining the strangest opinions of the system, in which they lived, the latter possessed not only the wisest code of laws, but an account of the origin of the world, free from errour, and which has stood the ground of all future researches. The later Jews fell, indeed, into the systems of the Greeks, but to this they were led by the ignorance, which accompanied their fallen state. Pythagoras, who gained his knowledge from the east, promulgated in the west a purer system: and, as he derived, it is most probable his ideas of the unity of God from the sacred writings, we may not, perhaps, err, in attributing to the early Jews his knowledge of the motions of the heavenly bodies. But I shall now, in pursuance of my general plan, lay down the appearances of the month of

JANUARY, 1813.

THIS month is very unfavourable to evening observations on the planets, for only one is visible in the hours before midnight, and this, which is Jupiter, does not rise till past six in the evening; he indeed affords ample opportunity to the astronomer to contemplate this noble orb, and the moons that accompany it. Of the nautical stars, we may point out, at six in the evening, the first of Pegasus, and the first of the Ram; the former to the west, and the latter to the east of the meridian; and Aldebaran to the east of the latter; and at nine the first of the Ram is to the west, Aldebaran to the east of the meridian; and the two first stars of the Twins will be distinguished to the east of these latter stars. My readers, who now know these stars very well, will not be displeased at these hints, as I hope they will not be lost, for each may impart some knowledge to those to whom these objects are unknown. In the middle of the month, the first of the Ram is on the meridian at six; and then, to the west, is the first of Pegasus, and to the east, Aldebaran; the two first stars of the Twins being considerably to the eastward, of which you will recollect the lowest to be the nautical star; and at nine Aldebaran has passed the meridian, when you will point out the first of the Ram to the west, the second of the Twins to the east, and the first of the Lion is high enough above the horizon to attract attention in the east.

The Moon is new on the 2d, at twenty-one minutes past five in the afternoon, but without an eclipse, being then upwards of three degrees in her upright north of the ecliptick. On the 4th, her crescent is seen near the south-west, soon after sun-set, being in the constellation of the Goat, whose two first stars she passed very early in the morning, and, soon after eleven in the evening, she passes the eighth *. On the 5th, she passes the ecliptick, or earth's path, in her descending node, that is going from the northern to the southern hemisphere, the sphere of heaven being divided by the ecliptick into

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* θ ♑.

these two hemispheres. For obvious reasons, there is not an eclipse: under her we may see the four small stars in the tail of the Goat, and above her the second of the Waterbearer, but she has passed the line between this star and the four small stars. On the 6th, she has above her the four small stars in triangle of the Water-pot, and still higher the four stars in square; but she does not reach the line drawn through the two western of them till the next day.

On the 7th, the Moon is seen under the four stars in square, having passed the line, drawn through the two western of these stars, and produced, before noon. Of these stars, we now notice, particularly, that nearest to the Moon, as it is a nautical star, the first of Pegasus *. On the 8th, she is on the meridian at fifty-five minutes past four, being then under the four stars in square, but to the east of the line drawn through the two eastern of these stars. On the 9th, she is on the meridian at three quarters past five, when we see above her, to the east, the three first stars of the Ram, and, to the west, the

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* For directions relative to this star, see volume for 1812.

our stars in square. On the 10th, she is on the meridian at thirty-six minutes past six, having above her the nautical star the first of the Ram, which cannot fail now of being noticed by the least attentive observer. Below her, to the east of the meridian, is Menkar, with the small stars in the head of the Whale. At six she is thirty-six degrees five minutes from Aldebaran to the east of her.

On the 11th, the Moon is on the meridian, at twenty-nine minutes past seven, having below her, but a little to the west of the meridian, Menkar, or the first of the Whale. The first of the Ram is now above her, at a considerable distance to the west; the Pleiades above her to the east of the meridian; and she is evidently directing her course towards Aldebaran, to the east of her. On the 12th, she is on the meridian at twenty-three minutes past eight, having now Aldebaran and the Hyades to the east of her, and the Pleiades above her to the west of the meridian. The nautical star, Aldebaran, she does not pass before she sets, but her approaches to him mark this beautiful star; and, this night, one of the Hyades suffers an occultation. This is the third of the Bull, which touches the eastern limb of the

Moon at forty-four minutes past midnight, the star being seven minutes twenty seconds south of the Moon's centre, and it remains obscured till thirty-eight minutes and a half past one, when it emerges, being then six minutes and forty seconds south of her centre. At forty-seven minutes past one, she passes the first fourth, and at twelve minutes past two, the second fourth of the Bull. On the 13th, she passes the meridian at twenty minutes past nine, having now Aldebaran to the west of her, the tips of the Bull's horns above her, and the beautiful constellation Orion below her to the east of the meridian. At nine, you should point out to the young intended sailer, three nautical stars, which will fix themselves in his memory: Aldebaran, near the Moon, to the west; the first of the Ram, now removed to a considerable distance from her, also, to the westward; and the second of the Twins, the lowest of the two bright stars, at a considerable distance to the east of her.

On the 14th, the Moon passes the meridian, at eighteen minutes past ten, being now directly under the seventh and twelfth of the Twins; below her, to the east, is the third, and above her, at a considerable distance, and also to the east, the two first stars of the Twins, the nautical star being the lowest; and below them, at some distance, Jupiter. Sirius, below, on the eastern side, and Orion, on the western side of the meridian, give splendour to the southern region. During the night we may observe her passage by and under the thirteenth of the Twins. On the 15th, she is on the meridian at sixteen minutes past eleven, being then under the sixth and fourth of the Twins, the former to the west, the latter to the east of the meridian. To the east, above her, are the two first stars of the Twins, the nautical star being the lowest; and, below her, the two first stars of the Lesser Dog; at a considerably greater distance than these stars, to the east, is Jupiter, below whom we remark the nautical star, the first of the Lion. Sirius is now near the meridian, to the west.

On the 16th is full Moon at four minutes past six in the afternoon, but without an eclipse, as she is upwards of two degrees south of the ecliptick. She rises under, and almost in a line with the two first stars of the Twins, the nautical star being nearest to her, and her recess from these stars and approach to Jupiter form a striking feature in the heavens of this night. She is evidently directing her course under the planet, but does not pass him till the next day. On the 17th, she rises under Jupiter, having passed him in the forenoon of this day. Of course she has travelled considerably from the two first stars of the Twins; and we shall now notice her recess from the planet, and approach to the nautical star, the first of the Lion. She travels, this night, in the barren space between the Crab and the Lion. On the 18th, she passes the ecliptick soon after noon, in her ascending node, or going from south to north, but, for obvious reasons, without an eclipse. She rises under the stars in the head of the Lion, and is followed by the first star, or Regulus, the nautical star; and her progress by this star will be remarked during the night. She passes it at an hour and a half past midnight, nearly half an hour before she passes the meridian, and, consequently, abundant opportunity will be offered, if the night is fine, of pointing out this nautical star to the young sailer.

On the 19th, the Moon rises under the body of the Lion, the nautical star of this constellation being at some distance, and the second not yet risen. As the night advances, we shall notice, around her, the stars of the Lion, which, with

Jupiter at their head, are the chief decoration of one part, as the stars of the Bear are of another part of the eastern hemisphere. On the 20th, she rises under the Lion soon after the second of this constellation, and is followed by the second of the Virgin, which she does not, however, pass before moon-set. During the night, therefore, we notice her heading the five stars in triangle of the Virgin, and directing her course to the third of this constellation. On the 21st, she rises just before the seventh of the Virgin; and, during the night, her progress from this star to the third will be noticed, but she does not pass the latter star till near seven of the following morning. On the 22d, she rises under the five stars in triangle of the Virgin, and nearest to the third, and is followed by the first, or Spica, a nautical star, which will be noticed by the evening traveller during the morning of the 23d; and on the 24th, she rises in the morning soon after the first of the Virgin, being between this star and the tenth and eleventh of this constellation.

On the 25th, the Moon rises, of course, in the morning, as she does to the end of the month, rising this morning before the two first stars of the Balance, but she does not pass between them till sun-rise, directing her course above Mars, who is to the east of her, at some distance. On the 26th, she rises under the two first stars of the Balance, being, indeed, under the third of this constellation, as she passes this star at twenty-eight minutes past one; and at fifty-eight minutes past five, she passes the seventh: to the east of her will be noticed Mars, and the second of the Scorpion. On the 27th, she rises with Mars, and the second of the Scorpion, and this groupe will be soon improved by the appearance of Antares. On the 28th, she rises nearly at the same time with Antares; and to the east of her, afterwards, will be noticed Saturn, Mercury, and Venus; and her progress by these planets will amuse those who will dare the cold air of the morning to observe them.

Mercury is a morning star during the whole month, too near the Sun to be observed in the former part, but his stay above the horizon before sun-rise is continually increasing. He is stationary on the 8th, and at his greatest elongation on the 20th. His position, however, is unfavourable for observation, being in the ninth and tenth signs, and in the latter from the 13th. His motion is first retrograde, and, of course, afly the end of the month, but he is on the meridian at midnight on the 23d, and will consequently present himself very favourably for observation at ten o'clock during the whole of the month. His motion is retrograde, through three degrees and a half, being at first to the east of the Nebula in the Crab, and the two small stars known by the names of the Northern and the Southern Asses, the small star nearest to him being the Southern, or the fourth of the Crab. Above this star he passes, and under the Nebula, and his passage by these objects will sufficiently point them out to every observer. His brilliancy in the east, two hours after sun-set, will sufficiently distinguish him from every object in this hemisphere. The Moon passes him on the 17th. At ten at night, we may observe the following eclipses of his satellites. Of the first, on the 16th and the 23d; of the second, on the 7th; of the third, on the 30th; and of the fourth, on the 28th.

Saturn is a morning star, too near the sun to be visible in the former part of the month; but he is distinguished at the latter part by two inferior planets passing very near to him. Mercury, on the 26th, being only fifteen minutes from him to the south; and Venus, on the 31st, being only six minutes and a half from him to the south. As his duration above the horizon before sun-rise on the last day is little more than an hour and a quarter, and he is in an unfavourable position, being in the tenth sign, at the east of the head of the Archer, it is evident that these conjunctions will not be much noticed. His motion is direct through three degrees from the western to the eastern side of the head of the Archer. The Moon passes him on the 30th.

Herschell is a morning star, and is pointed out, as before observed, by Mars, on the 21st. His motion is direct through seventy minutes between the two stars, the tenth and eleventh of the Balance. The Moon passes him on the 26th.

The Sun's apparent diameter on the 1st is thirty-two minutes thirty-five seconds, and, on the 24th, thirty-two minutes thirty-two seconds. The Moon's apparent diameter first increases, then decreases, and afterwards increases. On the noon of the 1st, it is thirty minutes sixteen seconds; of the 12th, thirty-two minutes twenty-eight seconds; at midnight of the 24th, twenty-nine minutes thirty-six seconds; and of the 31st, thirty-one minutes twenty-six seconds.

For the appearance of the fixed stars, at certain hours, consult the volume for 1806, according to the following Table of Positions; the first column indicating the position described in that volume; and the other columns, the time when it is visible; the figure at the head denoting the day of the month, the figures in the columns the hour and minutes. The black, horizontal line, drawn through each column, points out the hours before and after midnight: those above, being before midnight; those below, after midnight.

TABLE OF POSITIONS.

Pos.	1		8		16		24	
	h.	m.	h.	m.	h.	m.	h.	m.
X.	4	43	4	12	3	38		
XI.	6	44	6	13	5	39	5	5
XII.	8	50	8	19	7	45	7	11
I.	10	40	10	9	9	35	9	1
II.	0	43	0	12	11	38	11	4
III.	2	32	2	1	1	27	0	53
IV.	4	53	4	22	3	48	3	14
V.	6	44	6	13	5	39	5	5
VI.			8	9	7	35	7	1

FEBRUARY, 1813.

THE Greeks were very fond of what they called wisdom, and their vanity prevented them from making those acquisitions in science, which might have been expected from their talents and application. They had access to the writings of the old testament, which were translated into their own language; but it does not appear, that they made the use of them that might be expected. They looked upon themselves as the wisest of nations, and disdained to owe their knowledge to the barbarians, for so they called all other nations; though, on examination, it will be found, that almost every thing valuable among them was derived from foreign sources.

The origin of the world would naturally be a question among these philosophers; and we need not be surprised at the opinion being entertained, that it was eternal. How different were the views on this subject of the inhabitants of Palestine! The work in the hands of every one, and ordered to be diligently read by every one, begins with clearing the mind from errour on this important topick. At first, they say, God created these heavens and this earth—not in the beautiful order in which they now appear to us. for they were a confused mass, in which all the elements were mingled together, till, by the command of the Almighty, they were separated from each other, and took the places destined for them by the great Creator. Thus, in the moral world, when every thing appears to be in confusion, and all notions of right and wrong are confounded, He, who stills the waves and the madness of nations, can preserve the seeds of good to spring up to a plentiful harvest. Hence, said the sublime poet, we will not be afraid though the mountains be moved, and cast into the midst of the sea. There is one at whose word all tumults shall subside, and the reign of desolation shall not be perpetual.

In the books of the Greeks and Romans we read of their chaos; but it is evident, that they were indebted for the opinion to the sacred writers. The development from this chaos, is, however no where so simply and clearly described as in, the first chapter of Genesis. Light was first separated; then the air; afterwards, the water was drained from the earth, and occupied the great depths, and the surface of the earth was distinguished into land and water, the land becoming the basis of vegetable life. After these grand operations, the sun and the moon became visible from the earth, and produced the changes from light to darkness, becoming the regulaters of future times and seasons. Preparation was now made for animal life, which began with fishes and birds, proceeding from the seas; and then the earth produced its living creatures, the last of whom was man, formed from its dust, and endued with higher powers by the great Creater. To man, the great charter of dominion over all was given, not to rule as a tyrant, but, by wisdom and discretion, to make this world productive of happiness to all under his controul. He was to subdue the earth to useful purposes. Alas! how far has he not wandered from the original design of his creation! Still the word of God cannot be without effect: it shall not return to him unaccomplished. The earth shall still be filled with the glory of God, and every device of man, by which it is debased, shall come to nought.

Thus clearly and plainly is described the origin of these things with which we are more nearly concerned. But the internal structure of the earth, or the nature of the space some millions of miles from it, formed no part of the divine communication. These things were left to the natural sagacity of man on which he might exercise his conjectures; but it is evidently not within the reach of his powers to explore such distant regions. Whatever may be advanced upon such a topick, is matter of opinion. However great the name may be by which any system is supported, respecting substances so remote from our observation, we cannot place confidence in them, but on grounds which will stand the utmost scrutiny. How far the system of Attraction has a claim to our belief, either from the authority of a name or from the thing in itself, it may not be useless to enquire; but it is certain, that, if we cannot conceive it to exist, however plausible the theory may be which is formed upon it, the doctrine itself must share the fate of the crystalline orbs, and serve to warn us against too rash a decision on subjects beyond the reach of our ken. Though we should banish attraction from the regions of astronomy, the science will not suffer; for its great and important truths may be taught without any reference to the term, or the powers supposed to exist in it and gravitation. But we will now go to the events of this month.

This month is distinguished by two eclipses: the one of the Sun, on the 1st; the other of the Moon, on the 14th; the former only visible in these countries, and that only partially, as the Sun rises eclipsed. Of the planets, one only is visible in the evening, but this is Jupiter; and he is seen, soon after sun-set, in the east, and affords sufficient facilities to the astronomers to observe the eclipses of his moons.

The Moon is new on the 1st, at thirty-six minutes past eight in the morning, and she crosses the ecliptick, in her descending node, at night. The consequence is, an eclipse of the Sun, which rises eclipsed at twenty-seven minutes and a half past seven; its greatest obscuration is at one minute past eight, and the eclipse ends at eleven minutes and three quarters past nine. The digits eclipsed are seven degrees twenty-six minutes on the Sun's southern limb. The crescent of the Moon will be visible on the 2d, as, though she is a little south of the ecliptick, she is in a favourable sign, entering upon the twelfth under the eighth of the Waterbearer. On the 3d, she is seen under the four stars in square, having passed, some time, the line drawn between the two western of these stars and produced. The young sailer will notice, that the nearest of these stars to the Moon is the nautical star, the first of Pegasus. On the 4th, she is perceived to have traversed nearly the whole space under the four stars in square, though she does not reach the line drawn through the two eastern of these stars till after moon-set. On the 5th, she is seen under the small stars in the band, connecting the two fishes; and above her, at some distance, we notice the nautical star, the first of the Ram. She is directing her course through the space between this star and the first of the Whale, but evidently nearest to the latter star. On the 6th, we perceive, still above her, the three first stars of the Ram, the nautical star distinguishing himself by his superior brightness. The small star directly before her is the first fourteenth of the Whale, and this she passes soon after midnight. It is evident, that she will pass the line, between the first of the Ram and the first of the Whale, before her next appearance, and that she is directing her course to the Hyades and Aldebaran.

On the 7th, the Moon is on the meridian at nineteen minutes past five, having above her on the west, the first of the Ram, and below her the first of the Whale, the latter star being near to the meridian to the east. As the night advances, we shall notice, above her, the Pleiades and Aldebaran, with the Hyades. On the 8th she is on the meridian at thirteen minutes past six, having the Pleiades directly above her, and the nautical star, Aldebaran, to the east of her, who, by his superior brightness, will make an impression on the observer. Directly under her, but nearest to the horizon, is the third of Eridanus, or the River. In this situation we observe the nautical stars in Aries and the Twins are at a considerable distance from her, the former to the west, the latter to the east; and it is evident that she will pass the third of the Bull, the bright star in the Hyades, and Aldebaran, before her next appearance. On the 9th, she is on the meridian at eight minutes past seven; Aldebaran, with the Hyades, being now to the west of her, and Orion strikes us with his lustre, below her, to the east. The three nautical stars, the first of the Ram, at a considerable distance from, and Aldebaran, near to the Moon on the west, and the second of the Twins, at a considerable distance to the east, should be now particularly pointed out to the young intended sailer.

On the 10th, the Moon is on the meridian at four minutes past eight, having under her Orion, the third and second stars being to the west, and the first near to the meridian on the east. Above and near to her on the west, is the sixth, and, higher up, the second of the Bull, or the stars at the tips of the horns, the southern horn being the nearest. Above her, to the east, are the seventh and twelfth of the Twins, and farther off the two first; below her is the third, which she will have passed before her next appearance. On the 11th, she is on the meridian at one minute past nine, having now below her, to the west, the third, and above her the sixth of the Twins. Sirius is now almost directly below her, being to the west of the meridian, and the third of the Great Dog, to the east. Above her, at some distance to the east, are the two first stars of the Twins, the nautical star, distinguished by being the lowest, and Jupiter, who, with these stars and the two first of the Lesser Dog below them, and Orion, Aldebaran, and Capella, form a fine groupe around the Moon. She passes the sixth of the Twins about an hour and a half after midnight. On the 12th, she is on the meridian at fifty-seven minutes past nine, having now above her, to the west, the two first stars of the Twins, and below her the two first of the Lesser Dog. To the east of her is Jupiter, whom she will pass before her next appearance; and, beyond him, our attention is directed to the nautical star, the first of the Lion. This evening the nautical star, the second of the Twins, will be clearly pointed, as being the nearest to the Moon of the two bright stars above her. On the 13th, she is on the meridian at fifty-one minutes past ten, Jupiter being now to the west of her, as she passed him a little before noon. Above her are the two small stars in the Crab, with the Nebula; and below her, the small stars in the head of the Hydra. The two nautical stars, the second of the Twins and the first of the Lion, are now at nearly equal distances from her, the former above her to the west, the latter below her to the east. On the 14th, she is on the meridian at forty-three minutes past eleven, having, directly above her, the small stars in the head of the Lion; the nautical star Regulus, or first of this constellation, being to the east of her, and Jupiter, at a considerable distance from her to the west. Below her is Alphard, the first of the Hydra. On this day, she passes the ecliptick in her ascending node, between nine and ten in the morning; and, as she is near the full, an eclipse may be expected.

On the 15th is full moon, at forty-three minutes past eight in the morning, at which time is an eclipse, and, of course, not visible in our island. The eclipse begins at ten minutes past seven in the morning, and ends at two minutes past ten; the digits eclipsed being on the south limb, seven degrees and three quarters. In the evening she rises under the first of the Lion, and is perceived to be receding from it during the whole of the night: in which, if fine, many mothers will point out this nautical star to their children. In the former part of the night, the part of the eastern hemisphere distinguished by the two first stars of the Twins, Jupiter, the first of the Lion, and the Moon, will fix their attention. At thirty-three minutes past ten, she passes the thirteenth of the Lion. On the 16th she rises nearly at the same time with the second of the Lion, the first being now at a considerable distance above her; and the stars in the

Lion, the first, third, fourth, and second, will, notwithstanding her splendour, be distinguished during the former part of the night over her; and we shall perceive below her, in due time, the five stars in triangle of the Virgin. On the 17th, she rises under the second of the Virgin and the second of the Lion; the former near to, the latter at a considerable distance from her. Her progress from the second by the seventh of the Virgin will be noted during the night, as she passes above the latter star before sun-rise. Before midnight, the two nautical stars, the first of the Lion and the first of the Virgin, will attract attention, as she is between them, but nearest to the latter star.

On the 18th, the Moon rises under the five stars in triangle of the Virgin, the third of this constellation being near to her, and her recess from this star will be noticed during the night; and it will be perceived, that she will pass the first of the Virgin at some distance from the star. On the 19th, she rises with the first of the Virgin, having passed this nautical star about sun-set; and, as it is the only star of the first magnitude, or, indeed, of any brilliancy, near her, it cannot fail of attracting attention. On the 20th, she rises with the tenth and eleventh of the Virgin, having lately passed these stars, the tenth being above, and nearest to her; and during the night, she is perceived to be directing her course through the space between the two first stars of the Balance. The nautical star, the first of the Virgin, is now at a considerable distance from her to the west. On the 21st, she rises a little before midnight, under the two first stars of the Balance; and during the morning of the 22d, her recess from them will be noted. She is nearest to the second, the highest of these stars. On the 23d, she rises in the morning, and is followed, soon after her rising, by the second of the Scorpion. As she ascends the heavens, the groupe formed by her, the second and first of the Scorpion, and Mars, to the east of her, will excite attention. On the 24th, she rises nearly at the same time with Antares, at some distance from her; and is followed by Mars, whom she will evidently pass before her next appearance. On the 25th, she rises after Mars, and, before sun-rise, is perceived to be directing her course towards Venus, at a considerable distance from her; but she does not reach this planet this month, though she passes Saturn on the 26th.

Mercury is a morning star, in an unfavourable situation, and with a southern latitude continually increasing. On the 1st he is not seven degrees above the horizon at sun-rise, near the south-east, and, consequently, few but the keen astronomers will see him this month. The Moon does not pass him this month, being to the east of him on the 1st, and to the west on the last day of the month.

Venus is a morning star, at first at a considerable distance from the Sun; but she is in an unfavourable situation, and in her descending node in the second week. On the 1st, her height above the horizon at sun-rise is not nine degrees, and this is continually decreasing, three causes conspiring to diminish the height; her distance from the Sun decreasing, the unfavourableness of her position increasing, and her northern latitude decreasing, till she passes the ecliptick, and then her southern latitude increasing. On the 1st, she is on the eastern side of the head of the Archer, from which place she moves with a direct motion, through thirty-five degrees. Saturn is above her, within the distance of seven minutes; and the rapidity of her progress will be observed by her daily recess from this planet. On the 14th, she passes under the two first stars of the

Goat, and ends her course above the four small stars in the tail of this constellation. The Moon does not pass her this month, though she does in a few hours after the expiration of it.

Mars is a morning star, on the meridian at seven in the morning of the 6th, and at half past six on the last day of the month. His motion is direct through seventeen degrees, being on the 1st to the west of the second of the Scorpion, passing above Antares at the distance of five degrees on the 7th, and finishing his course above the Nebula, to the east of the eighth of the Serpent-bearer. The Moon passes him on the 24th.

Jupiter is in a very favourable situation, being on the meridian on the 1st at twenty minutes past eleven at night, and on the 19th at ten. His motion is retrograde, through three degrees, receding continually from the small stars in the Crab, between which is the Nebula, and approaching the line produced through the two first stars of the Twins. As the darkness of evening comes on, he will be seen, in great splendour, in east by north, under the two first stars of the Twins. The Moon passes him on the 13th.

Saturn is a morning star, partaking with Venus of the unfavourableness of the sign, the tenth; in which they are on the 1st near to each other. But the motion of Saturn is slow, and, consequently, his duration above the horizon before sun-rise, and his height at that time, are daily increasing. His motion is direct, through two degrees and three quarters, receding from the head of the Archer, and directing his course through the barren space between the heads of the Archer and the Goat. The Moon passes him on the 26th.

Herschell is on the meridian at near three quarters past six o'clock in the morning of the 1st, and twenty-five minutes past five of the 21st. On the 17th, he is near to the eleventh of the Balance, the small star to the west of the second of the Scorpion; and this latter has been sufficiently pointed out by being a star of the second magnitude, to the west of, and near to Mars, at the beginning of the month. The eleventh of the Balance is only seven minutes and a half from Herschell, on this day, to the south: so that, during this month, this is a sufficient guide to him, for he moves through little more than the third of a degree during the whole month. His motion is direct; consequently, at first, he is to the west, and after the 17th, to the east of the eleventh of the Balance. The Moon passes him on the 22d.

The apparent diameter of the Sun on the 1st is thirty-two minutes and a half, and on the 25th thirty-two minutes twenty-one seconds. The Moon's apparent diameter first increases, then decreases, and afterwards increases. On the 1st, at noon, it is thirty-one minutes thirty-six seconds; and it increases to the noon of the 6th, when it is thirty-two minutes twenty-four seconds: it now decreases to the 21st, when it is at midnight twenty-nine minutes thirty-four seconds; and it increases afterwards to the end of the month, being, at last, thirty-one minutes forty-six seconds.

The positions of the stars for any hour of the night will be discovered by consulting the volume for 1806, with the following Table.

TABLE OF POSITIONS.

Pos.	1		8		15		22	
	h.	m.	h.	m.	h.	m.	h.	m.
XI.	4	32	4	4				
XII.	6	38	6	10	5	42	5	15
I.	8	28	8	0	7	32	7	5
II.	10	31	10	3	9	35	9	8
III.	0	20	11	52	11	24	10	57
IV.	2	41	2	13	1	45	1	18
V.	4	32	4	4	3	36	3	9
VI.	6	28	6	0	5	32	5	5

MARCH, 1813.

WHEN horses are broken in, it is customary to exercise them for some time, in pacing round in a circle; and a man stands in the centre, who, by a rope tied to the horse's bridle, prevents him from going out of his destined course. The horse, stimulated by the whip, pushes forward, but is continually pulled in by his manager. The animal may be said to be acted upon by two forces, the one, of his own exertion, the other, of the man's exertion. By the former, he would rush forward; by the latter, he is continually pulled in. Should we give the name of attractive to the latter force, we might not use an improper term, if properly understood; though it would be evidently absurd to apply it to the horse. All the force by which he is attracted to the centre, is entirely repugnant to his disposition; and all his desire is, to get as far from it as possible, and to be out of the reach of the lash.

The rate at which the horse goes, the space he describes in any time, the tension of the rope by which he is held in, the time he employs in performing his rounds, have all a dependance upon each other: and, if two horses were seen exercising in this manner, their periodical times, velocities, rounds, and attractive forces, might be compared together. This is the subject of the second section of Sir Isaac Newton's principles; and he lays down, from demonstration, the laws, to which horses, or any other bodies, would be subject in revolving round a centre. These bodies, in their motions, he conceives to be acted upon by a force, which he calls the centre-seeking force; and it is in this term that many mistakes on this subject originate.

That the horse is not actuated by a centre-seeking force in himself, no one can hesitate to affirm; the force is a pulling force in the man, who keeps him in the round. But supposing, that instead of a horse, we consider a stone, whirled round in a string, would it not be equally improper to imagine that there was a centre-seeking force in the stone? The stone is inanimate; it seeks nothing; it is passive in every part of its motion, being impelled forward or backward by the force of the slinger; and when he loosens the string, it moves rapidly in the direction which he designed. We should be careful in the use of words: centre-seeking cannot be applied to things inanimate; and when the term is so used, we must ask ourselves the question—Whether the force, which produces the motion towards the centre, resides in that centre, in the moving body, or in neither one nor the other?

That bodies may move round a centre in either of these manners, we know by common experience. The instances already alledged of the horse, and the stone in the sling, shew the cases of animate and inanimate bodies moving round a point, when the force, which keeps them in their orbits, resides in the centers; and in the case of the animate body, it is against his will, and in the case of the inanimate body, it is passive, If it is allowed, that all bodies moving in a curve are acted upon by a force tending towards the centre, then numberless instances may be produced, where nothing exists in that centre to exert any influence at all. Thus, we may see a number of regimental horses, with their riders, going round and round in the same ring for a great length of time; and the cause of the motion is to be looked for only in the man and horse. The space within the ring is void; and though the horses may be said to be acted upon by a centre-seeking force, the men who direct their motions would be very much puzzled to understand the nature of its operation.

When we see a cork in a mill-pond moved 'round and round by the force of the water, we have an instance of a curvilinear motion, in which the body moved is perfectly passive, and the force by which it is urged on has no reference to any centre, its direction being owing to the impulses of the water in which it moves. When we see the little pieces of gold-leaf moving around and around by the barrel of an electrical machine, we are at a loss to understand by what force they are actuated: there is something propelling the leaf from the barrel, and something perhaps propelling it back again; but these somethings puzzle the philosopher. They afford us an instance, however, of a body moving round and round: and if it may be said to be actuated by a centre-seeking force, there is nothing in the centre to occasion the motion, which is to be accounted for from other causes.

I will leave you, for the present, to consider many other instances, which will occur to you of similar motions, whence you will probably arrive at the same conclusion as myself: that, when we talk of a body being acted upon by a centre-seeking force, we must not be led to suppose that there is really a cause of motion in that centre, unless it can be plainly shewn to exist there. If we see no reason to believe that there is a cause of motion in the centre, we must attribute the motion of a body in a curve to some cause, which it will be our business to discover; it may be with ease or with difficulty, or, perhaps, it may be beyond the reach of our powers. In all cases, we should be careful of affirming positively without due investigation. But the business of the month now calls us to another employment.

On the 2d of this month is new Moon, at half past nine in the afternoon, but without an eclipse, as the Moon is then two degrees south of the ecliptick. On the 4th, her crescent is seen in the evening in the west, under the small stars in the band of the Fishes, the three first stars of the Ram being above her, and at a considerable distance. On the 5th, she is seen to be directing her course between the first of the Ram and the first of the Whale, but considerably nearer to the latter star; the small star below her is the thirteenth of the Fishes, which she passed at fifty minutes past four this afternoon. On the 6th, is an occultation, which takes place at thirty-nine minutes past eight in the evening, when the twelfth of the Whale is covered by the eastern rim of the Moon, the star being five minutes and three quarters north of the centre, and it emerges at thirty minutes and a half past nine, when it is seven minutes and twenty seconds north of the centre. At this time she crosses the line between the first of the Ram and the first of the Whale, the latter being known by being the brightest of the stars near her; and the former has been so often described as a nautical star, that it will be needless to say, that it is of the second magnitude, and has two distinguishing stars near it; but this may now be pointed out to the young sailer. Above her, at a considerable distance, are the Pleiades and Aldebaran, and she is evidently directing her course to the latter star. On the 7th, she is perceived to have travelled rapidly through a great part of the barren space between the head of the Whale and that of the Bull, but she does not arrive at the Hyades till to-morrow; and these stars, with Aldebaran and the Pleiades, are above her. On the 8th, is an occultation, which takes place, however, too soon after sun-set to be generally noticed, for the eastern rim of the Moon touches Aldebaran at six minutes after six, when the star is two minutes and a half north of the centre; and it emerges at nineteen minutes past seven, when the star is only fifty seconds north of the centre. In this interval, the young sailer may be asked for his nautical star, Aldebaran; and, if he has not been forewarned of the occultation, he will be surprised not to find it by the well-known marks of the Pleiades and Hyades.

On the 9th, the Moon is on the meridian at four minutes past six, being directly over Orion, and under the two stars in the tips of the Bull's horns, the second of the Bull being directly above her at some distance, and the sixth of this constellation, or tip of the southern horn, being to the east of her. Aldebaran, with the Hyades, is now at some distance to the west of her. On the 10th, she is on the meridian at seven, having near to, but below her, to the east, the third of the Twins, and above her, to the west, the seventh and twelfth of this constellation. Above her, to the east, at a considerable distance, are the two first stars of the Twins, the nautical star being the lowest; and to the east of the line drawn through them and produced, is Jupiter, under whom the Moon directs her course towards the first of the Lion, a nautical star, to be pointed out at this time to the east of the meridian, as are Aldebaran and the first of the Ram, to the west of it. As you cast your eyes from the Moon downwards, in the direction of the meridian, you will not fail of pointing out Sirius on the eastern, and the second of the Great Dog on the west side of it. On the 11th, the Moon is on the meridian at fifty-six minutes past seven, having above her the two first stars of the Twins, the first directly, the second, the nautical star, nearest to her to the east of the meridian. Below her are the two first of the Lesser Dog, the first to the east, the second to the west of the meridian. Jupiter is now at some distance from her; and it is evident that she will have passed under this planet before the morrow evening.

On the 12th, the Moon is on the meridian at fifty minutes past eight, Jupiter being now above her to the west, as she passed him in the afternoon; and at some distance above him are the two first stars of the Twins, the nautical or second star being nearest to him. The other nautical star, to which attention should be paid, is the first of the Lion, to the east, to which the Moon is directing her course. Underneath her are the small stars in the head of the Hydra, and above her, to the east, at some distance, those in the head of the Lion. On the 13th, she is on the meridian at forty-two minutes past nine, being now in the barren space between the Crab and the Lion, but nearest to the latter constellation, the small stars in its head being above her to the east, the tenth being directly above her, and the first of the Hydra almost directly below her. The first of the Lion is at some distance from her to the east, and Jupiter at a greater distance to the west. On the 14th, she passes the ecliptick, very early in the morning, in her ascending node, but, for obvious reasons, without an eclipse. In the evening she is on the meridian at thirty-one minutes past ten, having directly above her the third of the Lion, and the first, the nautical star, to the west of her, as she passed it at twenty-nine minutes past five in the afternoon. Her recess from this star, from its first appearance, will fix attention, and be the means of impressing it on the memory of the intended sailer. On the 15th, she is on the meridian at eighteen minutes past eleven, having above her, but a little to the east of the meridian, the eighth and fourth of the Lion: the second, being to the east of these stars, and brighter than them, will be distinguished. The first is now at a considerable distance to the west of her, and, at a far greater, the nautical star, the first of the Virgin.

On the 16th, the Moon, at first, heads the five stars in triangle of the Virgin, being above and near to the second of this constellation. As the night comes on, it may be perceived that she will pass above the seventh. She comes to the meridian at three minutes after midnight, the second of the Virgin being below her to the west of it, and three quarters of an hour after, is full Moon, but without an eclipse, as she is upwards of two degrees north of the ecliptick. On the 17th, she rises in the triangle of the five stars of the Virgin, being in the space between the seventh, third, and fourth of this constellation; and she is followed, soon after her rising, by the third, as she passes this star at eighteen minutes past eleven. On the 18th, she rises under and at some distance from the five stars in triangle of the Virgin, the third being the nearest to her. She is followed within half an hour by the first of the Virgin; and this nautical star, being the nearest bright star to the Moon, will thus easily be pointed out during the whole night. On the 19th, she rises above the tenth and eleventh of the Virgin, the first being now at some distance from her to the west, and she will be perceived to be directing her course through the space between the two first stars of the Balance. On the 20th, she rises above the line between the first and second of the Balance, which she passes about midnight, and directs her course to the third of this constellation. On the 21st, she rises under the third and seventh of the Balance, having passed the third at twenty-one minutes past five after noon, and the seventh at fifty-four minutes past nine, directing her course under the twenty-third of this constellation, which she passes before day-break. Under her, therefore, during the night, will be noticed the second of the Scorpion, and below it the nautical star Antares.

On the 22d, the Moon rises near midnight, soon after the second of the Scorpion; and, during the morning of the 23d, forms, with this star and the nautical star Antares, a varying triangle, which, with Mars to the east, gives an interest to the southern lower region. On the 24th, she rises in the morning under the seventh of the Serpent-bearer, and is followed by Mars; and the planet on the eastern, and the nautical star Antares, on the western side of her, will form objects of attention. On the 25th, she is followed, soon after her rising, by Mars, who is then directly under her; and, before day-break, Saturn will be noticed to the east of her; and the three will form a pleasing groupe. On the 26th, she rises under Mars and the small stars in the head of the Archer, which are between her and the planet, and she is very soon followed by Saturn; and her passage by this planet will engage the attention of the traveller before day-break. On the 27th, she is perceived to have passed Saturn, who, at her rising, is to the west of her, at some distance, being between her and Mars, but nearest to her. Above her are the two first stars of the Goat, under which she is directing her course. On the 28th, she rises under the two first stars of the Goat, now to the west of her; and on this day she passes the ecliptick, in her descending node in the afternoon, but, for obvious reasons, without an eclipse.

Mercury is in his superior conjunction on the 7th; and of course, from that time, an evening star, but too near the Sun, at first, to be visible. On the last day of the month, his stay above the horizon after sun-set is nearly two hours; and he is then under the three first stars of the Ram, and will be seen, before he sets, by many observers in the west-by-north. The Moon passes him on the 2d.

Venus is a morning star, but in a very unfavourable situation during the whole month, her stay above the horizon before sun-rise being at first only about forty minutes, and this is daily decreasing. She moves from the middle of the eleventh to nearly the end of the twelfth signs, whose inclination to the horizon is unfavourable to all objects rising in them; and, to add to the unfavourableness, Venus has an increasing southern latitude. The Moon passes her on the 31st.

Mars is a morning star, arriving at the meridian at six at the latter end of the month, and within half an hour of that time in the former part. His motion is direct through eighteen degrees, from a point near the eighth of the Serpent-bearer, but to the east of it, and ending to the east of the small stars in the head of the Archer. He passes the ecliptick in his descending node on the 13th, the twelfth of the Archer being to the east of him; and he is then near the western border of that branch of the Milky-way in which this star is placed. On the 18th, he passes under this star; and we may perceive that he is directing his course under Saturn. The Moon passes Mars on the 25th.

Jupiter is on the meridian at nineteen minutes past nine in the evening of the 1st, and at ten minutes past eight on the 19th. His motion is retrograde through fifty-six minutes to the 25th, when he is stationary, and, consequently, it is slow and direct after that time. During the whole month, therefore, he is seen nearly in the same spot in the barren region of the Crab, about six degrees to the west of the Nebula; having, when on the meridian, above him the two first stars of the Twins to the west of him; the nautical star being the nearest to him. This is a very advantageous month to observe him; and at nine in the evening of the 3d, 10th, and 26th, his first moon is eclipsed; of the 12th and 19th, the second; of the 14th and 21st, the third; and of the 19th, the fourth. Our Moon passes him on the 12th.

Saturn is a morning star, rising at first about two hours before the Sun, and every morning earlier. His motion is direct through two degrees proceeding from a small distance from the head of the Archer, into the barren space between this constellation and the Goat. The Moon passes him on the 26th.

Herschell is on the meridian at a little before five in the morning of the 1st, and at three quarters past three on the 20th. He is stationary on the 1st; after which, his motion is retrograde through twenty-two minutes; and we have a very good guide to him in the eleventh of the Balance, which he passes on the 15th; the star being then seven minutes and a half to the south of him. You remember this star by its being the nearest to the bright star, the second of the Scorpion, to the west of it; and, by directing a telescope of small power to this star, when near the meridian, at the times above mentioned, and near twenty degrees above the horizon, you cannot fail of discovering this planet; and his motion by the eleventh of the Balance will be very interesting. The Moon passes him on the 22d.

The apparent diameter of the Sun is on the 1st thirty-two minutes nineteen seconds; and on the 24th, thirty-two minutes six seconds. The apparent diameter of the Moon first increases, then decreases, and lastly increases. On the 1st, at noon, it is thirty-one minutes fifty-eight seconds; and it increases to the 5th, being at noon and midnight thirty-two minutes fifty seconds: decreasing to the 20th, it is at midnight twenty-nine minutes and a half; and at the end of the month it becomes thirty-three minutes four seconds.

The places of the fixed stars at night will be known by consulting the volume for 1806 by the following Table, referring to the positions described in that volume.

TABLE OF POSITIONS.

Pos.	1		8		16		24	
	h.	m.	h.	m.	h.	m.	h.	m.
I.	6	38	6	12	5	43		
II.	8	41	8	15	7	46	7	17
III.	10	30	10	4	9	35	9	6
IV.	0	51	0	25	11	56	11	27
V.	2	42	2	16	1	47	1	18
VI.	4	38	4	12	3	43	3	14
VII.	6	38	6	12	5	43	5	14

APRIL, 1813.

WHEN a body revolves in a curve, it is said to be acted upon by a force, which is called centripetal, or centre-seeking; but we are not at a loss for instances, in which bodies do revolve in curves, and yet there is nothing within the curve to act upon those bodies. Should there be, however, any thing within the curve in which this force may be supposed to reside, we are not to attribute the curvilinear motion of the body to this internal cause, without sufficient proofs of its existence. We may speak of a body being attracted or drawn by another, and yet, upon enquiry, we shall find, that there was no attraction or drawing in the case; and that the body supposed to be endued with this attractive power, is, in fact, emitting particles, which have the opposite effect.

A newspaper brought in wet from the press, is held to the fire to dry, and not unfrequently it is soiled by the bars, and sometimes burnt. The person who holds it hears this language: "Take care, the fire is drawing the paper; if you don't mind, it will be burnt." Now here is apparently an attraction. The paper moves gradually towards the fire, which, by common language, is supposed to be endued with this power. A slight examination of circumstances indicates a very different reason for this appearance. The paper is not attracted by the fire; but, on the contrary, it is pushed forward by an invisible and potent agent. The heat of the fire rarefies the air near to it, and hence there is a continual rush from the more distant air towards the bars. The newspaper, having a large surface, is very much exposed to this rush, and is, consequently, driven to, not attracted by the fire.

Here the cause of the motion of the paper is clearly understood. Though we cannot see the air, yet its power is known by a variety of effects produced by it in the motion of our ships, in the sails of our mills, in gentle gales, and violent hurricanes. Another instance of supposed attraction is much more difficult of solution. Take a stick of sealing-wax, and a piece of thread, which you may let hang down from the table. Apply the stick of sealing-wax to it, and draw it back again, and you perceive that the thread remains the same, unless you have moved it by putting the wax close to it. Now rub the stick of wax on the sleeve of your coat for a short time—half a minute or so—and bring the wax near to the thread at the bottom of it. You see, that the thread moves quickly to the wax, and, as it were, adheres to it. If a small piece of the feather of your pen is taken off, and put on the table, move the wax over it at a small distance, and on a sudden, the piece of feather jumps up, and adheres to the wax.

What shall we say to this appearance? Here is motion produced, and the cause of it is evidently in the wax. Are the particles of wax endued, then, with the power of attraction? Do they draw the thread or the piece of feather to them? We cannot say that the particles of wax have in themselves this power; for, till the stick was rubbed, it might have lain for ages near to the thread, or the piece of feather, without having the least effect upon either. What, then, has the act of rubbing done? Has it altered the situation of the particles of the wax? Apparently, the stick is the same as before, having acquired only a greater degree of warmth. But something has certainly taken place with respect to the wax, which makes it differ from a piece of wax that has not been rubbed, and to this something we must attribute the sudden approach of substances to the rubbed wax.

What, then, is this something? Here we may be at a loss, and it may require a vast number of experiments, and a length of time, before it is discovered. Yet, perhaps, when the cause is explained, it will be found as simple as that of the height of the mercury in the barometer. Before the pressure of the air was as well understood as it is at present, the strangest conceits were entertained on the cause of the mercury being sustained: but, when the decisive experiment was made, of a tube, open at both ends, the one immersed in a basin of quicksilver and standing upright, the other end terminating in the receiver of the air-pump; and it was seen, that as the air was exhausted in the receiver, the mercury rose in the tube, it could no longer be a question, that the rise of the mercury was owing to the pressure of the air on that in the basin. The mercury in the tube, and the remaining air in the receiver, were now understood to operate as an equivalent pressure to that of the air of the atmosphere, on the part which was secluded from it by the glass.

With this simple fact, many men were unacquainted for many ages; and, to this day, a trifling experiment, which we often see made by boys in the street, will puzzle numbers, who have not sufficiently considered the subject. A boy amuses himself by taking a piece of round leather, through which he passes a string, and having soaked it for some time in water, he places it on a stone, treading it firmly on; and from this time, the stone and leather adhere together, and he carries it about hanging at the bottom of his string. Whilst the leather is dry, he may tread it down as long as he pleases on the stone, but no such effect will be produced, no adhesion will take place. On pulling the string the leather feels the impulse, but the stone is left behind.

Does the stone, then, attract the leather, or the leather the stone? Is it by mutual attraction, that the adhesion takes place? If it were by attraction, how comes it to pass, that this cannot be done by dry leather? Knowing the cause in the pressure of the air, we can easily answer these questions; which may lead us to suspect, that, in the case of the stick of wax and the thread, attraction has as little to do as with the leather and stone. Till the stick of wax is rubbed, and the leather is wet, the thread does not cleave to the wax, nor the leather to the stone. We can account for the effects produced by wetting the leather, into whose pores another substance is introduced; but we cannot reason from it to the rubbing of wax, in which some change is made imperceptible to our senses, yet producing a sensible effect on objects within its influence. If there is such difficulty in objects within our reach, how careful must we not be in determining on the supposed actions of bodies on each other, which are many hundreds of millions of miles asunder!

On the 1st of this month is new Moon, at fifty-five minutes past seven in the morning, but without an eclipse, as the Moon is then above four degrees south of the ecliptick. On the 3d, she is seen in the evening under the Pleiades, and above Menkar, but nearest to the latter star: she is directing her course to the nautical star Al-

Aldebaran. Beside her, in west-by-north, Mercury will be discovered under the three first stars of the Ram, about an hour after sun-set. On the 4th, she is seen at first under the Pleiades; and her progress among these stars will be noticed during the night. The third of the Bull, the most eastern of them, she passes at fifty-nine minutes past six; the first fourth she passes at forty-three minutes past eight, and the second fourth at eight minutes past nine; but we shall not witness her passage by the noted star Aldebaran, as she does not pass it till after midnight, but her approach to it will point out this star, in a particular manner, to the young readers. On the 5th, we perceive that she has travelled some distance from Aldebaran, which is now below her; and she is more than midway between this star and the sixth of the Bull, or tip of the southern horn, under which she is directing her course to pass above the third of the Twins. On the 6th, she is seen between the two stars in the feet of the Twins and the first of Orion, the third of the Twins being to the east of her, as she does not pass this star till after midnight, but she passes the thirteenth at fifty-one minutes past ten. Above her we recognise the two first, the nautical star being nearest to Jupiter. On the 7th, she is seen above the third of the Twins and under the two first, being much the nearest to the third: she is directing her course towards Jupiter.

On the 8th, the Moon is on the meridian at fifty-five minutes past six, being almost in a line with the two first of the Twins, and having Jupiter above her but a little to the east; and her passage under him, with her increasing distance from the nautical star, the second of the Twins, will interest the observer. On the 9th, she is on the meridian at forty-seven minutes past seven, being now between Jupiter and the nautical star the first of the Lion, and at nearly equal distances from them, the former being to the west, the latter to the east of the meridian. Under her are the two stars called the first of the Crab, whose occultations by her we have recorded; but she now passes them at such a distance, that we may not expect this phœnomenon again for a considerable time. On the 10th, she is on the meridian at thirty-seven minutes past eight, the nautical star the first of the Lion being near to her to the east, as she passes it at seventeen minutes past eleven; and thus gives every mother an opportunity of making this nautical star known to the child destined for the sea. Above her, on the meridian, are the small stars in the head of the Lion. On this day she passes the ecliptick in her ascending node about day-break; but, for obvious reasons, without an eclipse.

On the 11th, the Moon is on the meridian at twenty-four minutes past nine, the nautical star, the first of the Lion, being now considerably to the west of her. She is directly under the body of the Lion; the fourth, eighth, and second, being above her to the east of the meridian; and she is directing her course to the three lower of the five stars in triangle of the Virgin. On the 12th, she is on the meridian at nine minutes past ten, having, near to her to the east, the second of the Virgin, which she passes before day-break; and above her, but to the east of the meridian, the second of the Lion, and the fourth and eighth to the west of it. On the 13th, she is on the meridian at fifty-three minutes past ten, being between the seventh and third of the Virgin; the former to the west, the latter to the east of her. Below her, to the east, at a distance, we notice the nautical star the first of the Virgin. On the 14th, she is on the meridian at thirty-six minutes past eleven, having under her, to the east, the nautical star the first of the Virgin, and to the west, the five stars in triangle of this constellation.

On the 15th is full Moon, at twenty minutes past five in the afternoon, but without an eclipse, as she is at this time above four degrees and a half north of the ecliptick. She rises nearly at the same time with the first of the Virgin; and her recess from this nautical star during the night, though its lustre will be diminished by her superior brightness, will sufficiently point it out to every observer. On the 16th, she is followed, soon after rising, by the two first stars of the Balance, between which she is directing her course to the third of this constellation. On the 17th, she rises under the two first stars of the Balance, but nearest to the second, and is soon followed by the third, as this latter star suffers an occultation, which commences at twenty-six minutes past ten, and ends at thirty-seven minutes and a quarter past eleven. The star on immersion is two minutes and twenty seconds north of the centre; and at emersion, six minutes and twenty seconds. Her course carries her over the seventh of this constellation, which she touches before sun-rise, but it does not emerge till after. The immersion takes place at thirty-three minutes past four in the morning, the star being five minutes south of the centre. During the night, we notice, to the east of her, the nautical star Antares, and between her and that star the second of the Scorpion. On the 18th, she is followed, soon after her rising, by the second of the Scorpion; and her recess from this star, during the night, and her passage over Antares, which will be nearly directly under her, when she is on the meridian, will amuse the traveller. On the 19th, she rises nearly at the same time with the nautical star Antares to the west of her. On the 20th, she is followed, soon after her rising, by the twelfth of the Archer; and, during the morning of the 21st, her approach to it will be noticed as she passes this star about sun-rise: the small stars in the head of this constellation are between her and the two planets, Saturn and Mars.

On the 22d, the Moon rises in the morning, just above the stars in the head of the Archer, and she will be perceived to be directing her course above Saturn and Mars, under the two first stars of the Goat. On the 23d, she rises with Saturn, and is followed, soon after, by Mars, Both planets are now to the west of her; to the east of her are still the two first stars of the Goat; and her recess from the two planets will amuse the morning traveller. On the 24th, she rises under the two first stars of the Goat, which are now to the west of her, being between her and the two planets Mars and Saturn. On this day, in the evening, she passes the eclip-tick in her descending node; but, for obvious reasons, without an eclipse. On the 25th, she rises above the four small stars in the tail of the Goat, and directs her course under the four stars in square at a considerable distance from them; and on the 30th is new Moon at fourteen minutes past four in the afternoon, but without an eclipse, as she is then nearly five degrees south of the ecliptick.

Mercury is at his greatest elongation on the 1st, and in his inferior conjunction on the 21st, and stationary on the 11th. During the latter part of the month he will evade the researches of all, but the very keen observer; and the best must for a time, before and after the conjunction, be content to lose him. Before the conjunction he is an evening star, and in a favourable position, travelling slowly in the second sign. On the 1st, he is in the first degree of this sign; and on the 11th, in the sixth degree only, and his latitude is north, and increasing: what is more, he is on the 1st two hours above the horizon after sun-set; setting himself near west-north-west, near which point he sets till he ceases to be visible. Till he is stationary, he makes gradual approaches to the first of the Ram, and then recedes from it, and his duration above the horizon after sun-set daily decreases. The Moon passes him on the 2d, at some distance.

Venus is a morning star, but in a very unfavourable position, as she concludes her journey in the twelfth sign in the first week, and passes through the first sign in the remainder of the month. Her latitude is also southern, and her distance from the sun daily decreasing. On the 1st, her height above the horizon at sun-rise is little more than two degrees. The Moon passes her on the 30th.

Mars is on the meridian at six in the morning of the 1st, and at half past five on the 19th. His motion is direct through sixteen degrees, being on the 1st to the west of the small stars in the head of the Archer, under which he passes, being on the 2d under the first thirteenth, thirty-seven minutes from it: he is to the east of them on the 11th; and he ends his course in the middle of the barren space between the Archer and the Goat. In this course, he passes under Saturn, at the distance of less than a degree and a half, and his progress towards and from this planet will interest those, who seize the early hours to observe the planets. The Moon passes Mars on the 22d.

Jupiter is on the meridian at twenty-three minutes past seven in the evening of the 1st, and at twenty minutes past six of the 19th. His motion is direct through two degrees in the barren space about the beginning of the fifth sign. When on the meridian, he has above him, to the west, the two first stars of the Twins at some distance; the nautical star being nearest to him; and below him, the two first of the Lesser Dog; the Nebula in the Crab is near to him to the east. At nine in the evening of the 11th and 18th, is an eclipse of his first moon; of the 13th and 20th, of his second; and of the 26th, of his third. Our Moon passes him on the 8th.

Saturn is on the meridian at forty-two minutes past six in the morning of the 1st, and at half past five of the 21st. His motion is direct through thirty-six minutes to the 28th, when he is stationary, and, consequently, he is near the same spot during the whole of the month, which is in the barren region between the heads of the Archer and of the Goat; but he is nearest to the small stars in the head of the Archer. This barren space is made interesting by having the two planets Mars and Saturn in it during the greater part of the month. The Moon passes Saturn on the 22d.

Herschell is on the meridian at three in the morning of the 1st, and at three quarters past one of the 21st. His motion is retrograde through a degree; and we have sufficient directions to him when on the meridian, by noticing, first, the star of the second magnitude in the upper part of the lower region, near to the meridian, on the east; and then the small star on the meridian nearest to it; and, at the same height, the eleventh of the Balance, near to which is Herschell; and from this it is daily receding. The Moon passes him on the 18th.

The apparent diameter of the Sun is on the 7th thirty-one minutes fifty-nine seconds, and on the 24th thirty-one minutes forty-nine seconds. The Moon's apparent diameter first increases, then decreases, and lastly increases. At noon, on the 1st, it is thirty-three minutes twelve seconds; on the next day, at midnight, it is thirty-three minutes sixteen seconds; and it decreases to the 17th, when, at noon and midnight, it is twenty-nine minutes twenty-six seconds; and it then increases to the end of the month, when it is thirty-three minutes twenty-eight seconds.

The places of the fixed stars will be discovered by consulting the volume for 1806 by the following

TABLE OF POSITIONS.

Pos.	1		8		16		24	
	h.	m.	h.	m.	h.	m.	h.	m.
II.	6	48	6	22	5	53		
III.	8	37	8	11	7	42	7	13
IV.	10	58	10	32	10	3	9	34
V.	0	49	0	23	11	54	11	25
VI.	2	45	2	19	1	50	1	21
VII.	4	45	4	19	3	50	3	21
VIII.			6	24	5	55	5	26

MAY, 1813.

MATTER is defined to be a solid and extended substance; in other words, whatever is visible to the eye, and at the same time sensible to the touch, is matter. By the eye, its quality of extension is perceived; and this quality is also discoverable by the touch: but by the touch alone, the quality of solidity is ascertained. It is from the sense of feeling, that we discover the resistance that is made to us by bodies; and this so often, and at so early an age, that we are never likely to lose the impression. In this latter quality, the shadow differs from the substance; and when we speak of body or matter, we necessarily imply, that what is spoken of excludes every other body from the place it possesses.

Air, in this sense, does not differ in solidity from water, nor fire from earth. If we pass through the air or water easily, it is because the parts give way to us, and are driven from their places: but we cannot, with the utmost stretch of the imagination, conceive, that two bodies material should occupy the same place in the same time. Some amusing experiments are shewn, apparently, to contradict this assertion, and to try the faculties of the learner. Thus, a glass is filled with water, and being full, according to the expression, nothing can be put into it without expelling the water. This will be said by one not aware of what is going to be done; for, after he has made the assertion, to his surprise, a great quantity of salt is dropped in by degrees, and the water does not overflow.

Since two bodies material cannot occupy at the same time the same place, and solidity is an essential quality of matter; instead of giving to each particle of matter the power of attraction, we might rather say, that it is endued with one of repulsion. Experiments, indeed, seem to justify such an expression, for two bodies cannot be brought into contact, as is said to be proved by the chain of iron, at the bottom of which you may suspend what weight you please, and yet the links can never be brought to touch each other. This appears to be the case by passing the electrick shock through the chain, which emits a spark at every link.

It being allowed, that no two particles of matter can be brought into contact by any degree of pressure, we may ask, what is it that prevents the contact? If it is any thing in the two bodies, they become endued with a repulsive power; and whence is it, that, having a repulsive power, it should be able, at different distances, to change its nature, and to exert, at the distance of many millions of miles, an attractive force? A very able writer, not being able to get over this objection, has formed his system by allowing to matter both attractive and repulsive powers. He thought he saw the great bodies in nature attracting each other; and when he examined matter within his reach minutely, he found repulsion to be the law of the particles; consequently they were endued with both powers—one of repulsion for a small, and one of attraction at the great distances.

The system of this great mathematician has not met with a favourable reception. He* cartried the system of Newton to its farthest extent. In the twelfth and thirteenth sections of our admirable philosopher, are calculated the effect of attraction upon a particle placed within and without a sphere, formed of particles, attracting with a force acting according to a given law. The subject is amusing to mathematicians. Newton first supposes a particle of matter within a hollow sphere; and every particle in its surface is supposed to attract the particle with a force, measured by the square of the distance; so that it increases or decreases as this square decreases or increases. The consequence is, that the particle will be at rest.

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* Boscovich.

The above is strictly and mathematically true; and, in the same manner, various ingenious remarks are made, by placing the particle out of a sphere, and forming various laws of attraction; all of which would be equally true, if, instead of attraction, he had used repulsion. It was his intention, doubtless, to apply his supposed discoveries to the existence of things in nature; and as Kepler had discovered a proposition which led Newton to refer the motions
heavenly bodies to forces, varying invers
the square of the distances of the

each other, he could not consider his system as firmly established, without investigating, under all points of view, his doctrine of gravity or attraction.

Newton was not, however, bigotted to his term attraction, as some of his followers have been; and he seems to have been as much at a loss as any of us can possibly be on this subject. Hence, at the end of his eleventh section, he uses the following language:—" I employ the word Attraction here, generally, for any tendency of " bodies to approach each other; whether this " tendency arises from the action of bodies, " either mutually seeking each other, or acting " upon each other, by spirits emitted, or whether " it arises from the action of æther, or air, or " any medium whatsoever, corporeal or incorporeal, impelling, in any manner amongst themselves, the bodies swimming in it. In the " same general sense I take the word impulse; " considering, in this treatise, not the kind of " forces and physical qualities, but mathematical quantities and proportions."

On the 2d of this month, the Moon's crescent is seen, for a short time, above Aldebaran, near west-north-west, in the evening; and on the 3d she is perceived to have travelled beyond the tip of the Bull's southern horn, being under the seventh and thirteenth of the Twins, directing her course to the sixth of this constellation. On the 4th, she is under the sixth of the Twins, which star she passes at forty-seven minutes past eight in the evening; and above her we notice the two first stars of this constellation, the nautical star being nearest to her. She is directing her course under Jupiter, at some distance from her. On the 5th, she is seen to have approached much nearer to Jupiter, who is still above her, and, with the two first stars of the Twins, makes a pleasing groupe in her neighbourhood. On the 6th, she is seen above Jupiter, as she passed the planet in the morning, and the Nebula in the Crab about noon; above her are the small stars in the head of the Lion, and she is evidently directing her course to the nautical star in this constellation. On the 7th, we notice above her the nautical star the first of the Lion; and below her are the sixteenth and fifteenth of this constellation. In the morning she passed the ecliptick in her ascending node; but, for obvious reasons, without an eclipse.

On the 8th, the Moon is on the meridian at twenty-eight minutes past seven in the evening, the nautical star in the Lion being now to the west of her; and above her, at some distance to the east, are the fourth, eighth, and second, of this constellation. On the 9th, she is on the meridian at thirteen minutes past eight, being under the fourth, eighth, and second of the Lion; the two former stars being to the west, and the latter to the east of the meridian: to the east of her is the second of the Virgin; and thus she heads, till her setting, the five stars in triangle of this constellation. On the 10th, she is on the meridian at fifty-seven minutes past eight, being between the second and seventh of the Virgin, the former to the west, the latter, much nearer to her, to the east of the meridian. On the 11th, she is on the meridian at forty minutes past nine, having passed the five stars in triangle, which are now to the west of her; and below her, to the east, is the nautical star the first of the Virgin, which she will have passed before her next appearance. On the 12th, she is on the meridian at twenty-two minutes past ten, the first of the Virgin being now below her to the west, and the tenth and eleventh are to the east of the meridian. On the 13th, she is on the meridian at four minutes past eleven, having near her, to the west, the tenth and eleventh of the Virgin; the first being now at a considerable distance from her; and to the east the two first stars of the Balance, between which she is directing her course. On the 14th, she is on the meridian at forty-eight minutes past eleven, having above her, to the west, the second of the Balance, and near her, to the east, the third of this constellation; which, last month, we may recollect, suffered an occultation.

On the 15th, is full Moon, at twenty-six minutes past nine in the morning, but without an eclipse, as she is upwards of four degrees and three quarters north of the ecliptick. In the evening she rises first above the second of the Scorpion, and passes it early in the following morning. Under her we notice, during the night, the nautical star Antares. On the 16th, she rises considerably to the east of the second of the Scorpion, and is soon followed by the nautical star Antares, now to the west of her. On the 17th, she rises considerably to the east of Antares, and is afterwards perceived to be directing her course to Saturn, considerably to the east of her. On the 18th, she is followed, soon after her rising, by the small stars in the head of the Archer, but she does not reach them before sunrise. On the other side of them is Saturn, near whom the Moon will direct her course. On the 19th, she rises nearly at the same time with Saturn, as she passes this planet at sixteen minutes past eleven at night; and, during the morning of the 20th, her recess from this planet, and access to Mars to the east of her, will amuse the morning traveller.

On the 21st, the Moon rises in the morning under the two first stars of the Goat, Saturn being now considerably to the west of her, and Mars being below her, and her passage by this planet will be interesting. On this day she passes the ecliptick in her descending node; but, for obvious reasons,, without an eclipse. On the 22d, she rises considerably to the east of Mars, and is followed, soon after, by the small stars in the tail of the Goat, near to and under her. On the 23d, she rises below the eighth of the Water-bearer. On the 24th, she is in the stream from the Water-pot at rising, but does not reach the line drawn through the two western of the four stars in square before sun-rise. On the 25th, she is in the barren space under the four stars in square; and on the 29th is new Moon, at twenty-one minutes past eleven at night; but without an eclipse, as she is upwards of four degrees and a half south of the ecliptick.

Mercury is a morning star during the whole month, stationary on the 4th, and at his greatest elongation on the 18th. His position is unfavourable, as he is travelling in the first and second signs with a southern latitude, which increases to the 19th. On the day of his greatest elongation, he is only five degrees above the horizon at sun-rise; but this height rather increases to the end of the month; and the keen astronomer will, therefore, have frequent opportunities of making his observations on this planet, who eludes so often the researches of those who have not so acute a discernment. The Moon passes him on the 28th.

Venus is in her superior conjunction on the 25th, and too near the sun, during the whole month, to escape the superiority of his beams. She passes the second tenth of the Bull on the

26th, the star being forty-three minutes north of her. The Moon passes her on the 29th.

Mars is on the meridian at eighteen minutes past five on the morning of the 1st, and at half past four on the 22d. When on the meridian, on the 1st, the two first stars of the Goat are above him to the east, and Saturn is between him and the small stars in the head of the Archer to the west. He passes under the two first stars of the Goat on the 18th, and travels onwards in the barren part of this constellation. His motion is direct through thirteen degrees, and the Moon passes him on the 21st.

Jupiter is an evening star, being on the meridian at forty minutes past five of the afternoon of the 1st, and every day later. His motion is direct through four degrees and a quarter, ending under the Nebula in the Crab, and a little to the west of the fourth of this constellation. At ten in the evening are eclipses of the following moons: of the 1st, on the 11th and 18th; the second, on the 15th, 22d, and 29th; of the third, on the 3d; and of the fourth, on the 8th and 25th. Our Moon passes him on the 6th.

Saturn is on the meridian on the 3d, at three quarters past four in the morning; and on the 21st, at half past three. His motion is retrograde through somewhat more than three quarters of a degree; and when on the meridian, on the 1st, Mars is to the east of him at the distance of five degrees and a half; and the small stars in the head of the Archer about the same distance to the west. Above him, to the east, are the two first stars of the Goat. The distance of Mars from him daily increases, and the Moon passes near to him on the 19th, at sixteen minutes past eleven at night.

Herschell is on the meridian at near one of the morning on the 1st, and at three quarters past eleven on the 20th. We are directed to him by the eleventh of the Balance, the small star to the west of the second of the Scorpion. He is receding from this star towards the tenth, his motion being retrograde through a degree and a quarter, and ending within a degree east of the latter star. The Moon passes him on the 15th.

The apparent diameter of the Sun is on the 7th thirty-one minutes forty-four seconds; and on the 25th, thirty-one minutes thirty-seven seconds. The apparent diameter of the Moon first decreases, then increases, and afterwards decreases. On the 1st, at noon, it is thirty-three minutes twenty-eight seconds; and on the 14th, it is twenty-nine minutes twenty-six seconds; it becomes at noon, on the 29th, thirty-three minutes twenty-six seconds; and it ends with a magnitude of thirty-two minutes fifty-two seconds.

The situation of the stars, at any hour of the night, will be known by consulting the volume for 1806, according to the following Table.

TABLE OF POSITIONS.

Pos.	1		8		16		24	
	h.	m.	h.	m.	h.	m.	h.	m.
IV.	9	7	8	40				
V.	10	58	10	31	10	0	9	28
VI.	0	54	0	27	11	56	11	24
VII.	2	54	2	27	1	56	1	24
VIII.	4	59	4	32	4	1	3	29
IX.					6	4	5	32

JUNE, 1813.

IN sir Isaac Newton's admirable treatise, two things deserve particular attention, and they must not be confounded with each other—his mathematical reasoning, and his application of it to natural philosophy. Indeed, he entitles his work, " Mathematical Principles of Natural Philosophy." Of the mathematical part, very few can be complete judges; as there are not many who, having the skill, can employ the time and attention, which the study of so difficult and so abstruse a work requires. But, in the application of those principles, it is not, by any means, so difficult as is imagined, to determine whether the author has or has not been successful. Very great mathematical talents were employed on the Ptolemaic system, which led to many curious and useful investigations: but they could not prop up a system destined to fall by the discovery and improvement of the telescope.

The mathematical part of Newton's principles may be all true, yet his system of natural philosophy does not thence necessarily demand our confidence. Nothing can indeed be said too strong in support of some part of the mathematics of Newton where demonstration may be applied. Should the whole world perish, it will be equally true, that, wherever a body is projected, and a force acts upon it, drawing that body to a centre, with a force varying inversely, as the square of the distance, it will describe either a straight line or a circle, or one of the conick sections. But, when we say this, we must recollect, that the body must, in every case but that of the straight line, move in free space, or our conclusion is not true; and, consequently, if the space around the body should have any thing in it capable of resistance, the body will not move in any of the curves we have mentioned.

In the same manner as it is proved, that, according to one law of force, bodies will revolve in conick sections, it is proved, that, by another law, they will describe other curves. These laws may be made at pleasure; but the curves to be described by them are not so easily discovered. Newton has investigated a few of them;

and, what he has investigated, are among the easiest. The lives of men, from this time to eternity, might be employed in investigating all the curves that would arise from imagining different laws; and, when all this was done, not one of the curves so laid down would be made to correspond with any one curve actually described by any body in nature. It is one thing to imagine laws of forces; another, to pursue nature in all her labyrinths. It is one thing to write a romance; another, to describe the facts of real history.

The same age gave birth in England to two of the greatest geniuses that this country has produced, Newton and Milton. Both excelled in their respective walks, and their names will live on record to remote ages. The one composed a poem founded on the wildest conceits of imagination; such as disembodied spirits warring with weapons used by mortal men; and this in the regions of heaven, where the Almighty's throne is described according to the vulgar notions of earthly grandeur. The idea of war in heaven antecedent to the creation of this world, was borrowed from a passage in our sacred writings *, where

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* See the Revelations, chap. xii, v. 7.

the prophet is speaking of an event to take place many years after his time, that is, many years after the death of our Saviour: and what he describes in symbolical language, our poet has taken literally; and hence he converted heaven into fields of battle, and made it a scene of war, confusion, and bloodshed. His poetry is beautiful, his facts are imaginary.

They are mistaken, who suppose that the imagination has no place in the mathematicks. The same power may be exercised on the relations of lines and surfaces to each other, as in the description of chimeras dire, the anthropophagi, and men whose heads do grow beneath their shoulders. Let the idea of particles of matter attracting each other be impressed upon the mind, and it will then dilate upon their mutual actions, calculate the density of substances composed by them, whirl them at pleasure in empty space, and shew in what manner their motions will be disturbed by the actions of each upon the other. Newton was not inferior to Milton in imagination: but they employed it on different objects. Grant to Milton his embodied spirits, his empyrean heaven, his angelick warfare, and his heroes act as consistently as those of Homer at the siege of Troy. Grant to Newton the influence that certain particles are to have on each other, then his combinations of them will be valid, his system is complete. His ingenuity remains the same, whether any thing in nature corresponds with it or not. Milton's devils, and Newton's particles, perform the task assigned to them by these great masters of the drama; and we, who are admitted to be spectaters of the scene, cannot too much admire the skill of the artists *.

On the 1st, the Moon is seen in the evening in west-north-west, under the two first stars of the Twins and Jupiter, evidently directing her course near to the planet. On the 2d, she is seen under and near to Jupiter, whom she passes at thirty-nine minutes past nine; and this appearance will amuse the evening's walk. On the 3d, she is in the barren space between the Crab and the Lion, being nearly at equal distances from Jupiter and the nautical star. Above her are the small stars in the head of the Lion. On this day, she passes the ecliptick in her ascending node, about two hours before noon, but without an eclipse, for obvious reasons. On the

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* Spectatum admissi risum teneatis amici.

4th, the nautical star, the first of the Lion, is seen below and near to the Moon, and almost in a line with her and Jupiter; and her recess from this star will point it out sufficiently to every observer. Above her, at a considerable distance, are the three stars in the back and tail of the Lion, the fourth, the eighth, and the second. On the 5th, she is seen to have receded very considerably from the first of the Lion, being now nearly in a line with the fourth and third of this constellation, directing her course above the second of the Virgin, the most westward of the five stars in triangle. On the 6th, the second of the Virgin is seen below and near to her, the second of the Lion being now above and to the west of her. On the 7th, she is near the point of the angle formed by the five stars in triangle, the nautical star, the first of the Virgin, being to the east of her.

On the 8th, the Moon is on the meridian at eighteen minutes past eight, having almost directly under her the first of the Virgin, and thus giving every mother an opportunity of pointing out to the young intended sailer this nautical star. On the 9th, she is on the meridian at nine o'clock, having under her the eleventh, and to the west of her the tenth of the Virgin, the nautical star being now at a considerable distance from her to the west; to the east of her are the two first stars of the Balance, between which her course is directed. On the 10th, she is on the meridian at forty-three minutes past nine, having above her the second of the Balance to the east, and below her the first to the west of her; she is directing her course by the third. On the 11th, she is on the meridian at twenty-seven minutes past ten, having above her the twenty-third to the east, and below her the eighth of the Balance, to the west of her: the second and first of the Scorpion are of course below her to the east of the meridian. On the 12th, she is on the meridian at thirteen minutes past eleven, the two first stars of the Scorpion being below her to the west, the nautical star Antares being the lowest and nearest to the meridian. Above her to the east is the seventeenth of the Serpent-bearer. On the 13th, she is on the meridian at midnight, the nautical star Antares being at some distance below her to the west; and to the east of her, at nearly double that distance, is Saturn.

On the 14th, at twenty-eight minutes before one in the morning, is full Moon, but without an eclipse, as she is above three degrees and three quarters to the north of the ecliptick. In the evening she rises under the twelfth of the Archer, and as she ascends higher, Saturn is seen to follow her, though at a considerable distance. On the 15th, she rises with the small stars in the head of the Archer, being soon followed by Saturn, whom she passes before sun-rise. On the 16th, she traverses the barren space between the Archer and the Goat, and rises below and soon after the two first stars of the latter constellation, which, with Mars beneath them, are to the east of her, and Saturn is now about the same distance to the west of her. On the 17th, she rises under the two first stars of the Goat, now to the west of her, and above Mars; and, a little before midnight, passes the ecliptick in her descending node; but, for obvious reasons, without an eclipse. At thirty-six minutes past eleven, she passes very near to the eighth of the Goat. On the 18th, she rises nearly at the same time with Mars, who is now considerably to the west of her. On the 19th, she rises under the first of the Water-bearer, and, during the morning of the 20th, is seen travelling at some distance under the four stars in triangle of the Water-pot.

On the 21st, the Moon rises in the morning under the four stars in square. On the 22d, she rises under the four stars in square, but is to the east of the two eastern of them. On the 23d, she rises at nearly equal distances from the nearest of the four stars in square and the three first of the Ram. On the 24th, she rises under the three first stars of the Ram, and in her progress passes over the second fourteenth of the Whale, this star suffering an occultation at forty-two minutes and a half past two in the morning, being then nine minutes and forty seconds north of the centre, and emerging at half past three, being then eight minutes and twenty seconds north of the centre. On the 28th, is new Moon at twenty-six minutes past six in the morning, but without an eclipse, as she is nearly three degrees south of the ecliptick. On the 30th, she passes the ecliptick in the afternoon in her ascending node, but, for obvious reasons, without an eclipse.

Mercury is in his superior conjunction on the 21st, and to that time a morning star. On the 1st, he is only between five and six degrees above the horizon at sun-rise; and the power of the sun's beams before that time is such, that none but the very keen astronomer will discover him. Still less favourable will be the opportunities after the conjunction. The Moon passes him on the 28th.

Venus having passed the Sun so lately, is still too near it to be seen in the evening. She is now an evening star, but at the end of the month is only six degrees above the horizon at sun-set. The Moon passes her on the 28th.

Mars is stationary on the 29th, and to that time his motion is direct through little more than five degrees in the barren space of the Goat, ending about five degrees west of the small stars in its tail. He is on the meridian on the 1st at ten minutes past four in the morning, and on the 19th, at a quarter past three. When on the meridian, on the 1st, we perceive, above him, the two first stars of the Goat to the west, and he is seen to steer his course slowly towards the four small stars in the tail. The Moon passes him on the 18th.

Jupiter is an evening star, being on the meridian on the 1st at fifty-five minutes past three in the afternoon, and every day later. His motion is direct through five degrees and a half under the Nebula and two small stars of the Crab, called the Northern and Southern Asses. The latter of these stars, the fourth of the Crab, he passes on the 5th, the star being thirty-seven minutes and a half south of him. The Moon passes him on the 2d, at thirty-nine minutes past nine in the evening.

Saturn is on the meridian at three quarters past two in the morning of the 1st, and at three quarters past one of the 15th. His motion is retrograde through somewhat less than two degrees, being to the east of the small stars in the head of the Archer. The Moon passes him on the 16th.

Herschell is on the meridian at fifty-four minutes past ten at night on the 1st, and at twenty-nine minutes past nine of the 21st. His motion is retrograde through a degree; and we have a sure guide to him in the tenth of the Balance, the second small star from the second of the Scorpion to the west. He passes the tenth of the

Balance on the 5th, the star being then thirteen minutes south of him. The Moon passes him on the 11th.

The apparent diameter of the Sun is on the 1st thirty-one minutes thirty-five seconds, and on the 25th thirty-one minutes thirty-one seconds. The apparent diameter of the Moon first decreases, then increases, and lastly decreases. On the 1st, at noon, it is thirty-two minutes thirty-eight seconds; and on the 11th, twenty-nine minutes twenty-eight seconds: from this day it increases to the 26th, when it is thirty-three minutes eight seconds; and it decreases to the end of the month, finishing with a magnitude of thirty-one minutes fifty-four seconds.

The positions of the stars, at any hour of the night, will be known by consulting the volume for 1806, according to the following Table.

TABLE OF POSITIONS.

Pos.	1		8		15		23	
	h.	m.	h.	m.	h.	m.		
V.	8	55	8	26	7	57		
VI.	10	51	10	22	9	53	9	20
VII.	0	51	0	22	11	53	11	20
VIII.	2	56	2	27	1	58	1	25
IX.	4	59	4	30	4	1	3	28
X.			6	25	5	56	5	23

JULY, 1813.

"Nature and nature's laws lay hid in night;
" God said, 'Let Newton be,' and all was light."

A LIVING writer * gives us, in prose, the same sentiment; and adds to it a consequence, which was little to be expected from a philosopher. " Newton's account of the universe," he tells us, " and the laws by which it is regulated, " is founded upon the most indubitable princi-" ples of reason, science, and observation. We " are no longer compelled to wander through " the intricate mazes of hypothesis and conjec-" ture. Nature appears again in all her primi-" tive simplicity. Newton has dissolved the " chaos, and separated the light from the dark-" ness. His inimitable work, The Mathema-" tical Principles of Natural Philosophy, con-

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* See Bonnycastle's Introduction to Astronomy, letter viii, page 93.

" tains the true astronomical faith; and they
" who reject its doctrines, are the worst of here-
" ticks, as they shut their eye against the
" clearest of all light—demonstration."

In a former volume, I have given some account of the treatment of Galileo by the Inquisition; and if the writer of the above extract had been living at that time, we may ask, what part would he have acted? that of the cardinal, the persecuter, or that of Galileo, abjuring his faith? What, indeed, can be so ridiculous as to talk of heresy, and worst of hereticks, in a question of philosophy? No one admires the genius of Newton more than myself, yet I cannot be blind to his faults, nor will the superiority of his talents compel me to assent to a doctrine, which, so far from being founded on demonstration, is mere conjecture and hypothesis.

But is Newton's claim to superiority of demonstration so well founded as the writer seems to imagine? The two works written by Newton, his Mathematical Principles, and his Universal Arithmetick, contain much that is worthy of admiration; yet it is remarkable, that in both he offends against the laws required in strict demonstration. What shall we say of a writer, who, in the beginning of his Arithmetick, defines quantities in this manner: "Quantities are either greater than nothing, or less than nothing?"

This strange notion, Newton borrowed from a writer of this country, who was, I believe, the first corrupter of Algebra, though the French contend with us for that honour. In consequence of setting out so absurdly, and following the laws of strict demonstration, his work is a strange tissue of science and nonsense. At one time he astonishes us by the ingenuity of his efforts; at another, we are surprised that so deep a thinker could fall into such strange inconsistencies. But what could be expected otherwise from one, who should so confound the clearest of our ideas: for number implies several things; and to say that one is less than nothing, or many things are less than nothing, would not be admitted in common speech; though, dressed up in the language of the schools, it is pretended to be something very fine, and superior to the capacity of ordinary understandings.

The jargon thus adopted by Newton, now

passes current as a thing not to be contradicted, though it is amusing sometimes to see into what dilemmas it now and then throws his disciples. An instance of this kind may be seen in the work of a gentleman, for whom I entertain the sincerest respect, and who was brought up, like myself, to believe in these strange fictions; and he has shewn us, in a work lately published, what an opposition sometimes takes place between common sense and what is falsely called science *. In this work he enquires, in how many days a traveller will arrive at a place distant one hundred and ninety-eight miles, supposing him to go thirty miles the first day, twenty-eight the second, and every day two miles less than on the preceding day? The answer given is, that he will do it in nine days, or twenty-two days. And as "it may seem extraordinary," to use his own words, "that the traveller should arrive at his journey's end at two different periods," he explains it in the following manner:—The traveller arrives at his journey's end at the conclusion of the ninth day; but, by going on for six days longer, resting the sixteenth day, and

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* See Lectures on the Elements of Algebra, by the Rev. B. Bridge, page 189.

travelling back again for the last six days, "he "will, algebraically speaking, arrive at his journey's end again at the conclusion of the twenty-second day." Thus, according to this gentleman's notion, to be at rest one day, is to travel two miles less than he did the day before; and to go beyond his destined place and back again, is to arrive at the end of his journey algebraically. We would recommend our innkeepers to learn this doctrine, and to charge this writer, and all of his opinion, for post-chaises algebraically; whilst my ever-to-be-respected friend, Baron Maseres, and myself, and a very few others, who do not believe in quantities less than nothing, will content ourselves with leaving our chaises when we come to the end of our journey.

This example is deduced strictly from sir Isaac Newton's principles; and we need not be surprised, that, when they are closely followed, they should lead to such conclusions. The beauty of science is to lay down a basis in truth, and in every step of the reasoning undeniable propositions only are to be used. Against a conclusion so drawn, no one, who understands the subject, can shut his eyes; but, if a person sets out with what is false, and his subsequent reasoning is just, the conclusion must partake of the falsehood of the beginning. Having defined quantities to be some greater, some less than nothing, it is no wonder that they come to some that are of a doubtful nature, which they know not into which class to put; and on these strange ideal quantities, Sir Isaac Newton employed too much of his time; and his followers, equally with himself, have lost their labour. They astonish the vulgar, who conceive, that what is so much above their comprehension, is very sublime; whereas it is of no use in real life, and draws away the attention from more noble pursuits to very idle conceits *.

This month is distinguished by the number of occultations by the Moon which take place in it. There are six; and one of them is of a star of the first magnitude, the nautical star Regulus, the first of the Lion. A conjunction between Jupiter and Venus, would amuse very much our even-

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* See the note at the bottom of page 136, in Mr. Wood's Elements of Algebra, fifth edition: — "The "learner must at present take for granted that an "equation may be made up of as many simple factors "as it has dimensions;" — *i. e.* he must take for granted what is not true. [illegible]

[illegible]

ing walks, if they were not so near the horizon at sun-set; for they are below Mercury.

On the 1st, the Moon is seen, in the evening, under the nautical star the first of the Lion, directing her course to it; and at twenty-eight minutes past nine, her eastern limb touches it; the star being seven minutes and fifty seconds south of the centre. It remains covered till thirteen minutes and a quarter past ten, when it emerges at the distance of nine minutes south of the centre. The occultation takes place when the Moon and star are in west-by-north, and only about eight degrees above the horizon. Jupiter is to the west of them, near the horizon. On the 2d, she is seen to have receded considerably from the first of the Lion, being to the east of it, and under the three stars, the fourth, eighth, and second, of this constellation. On the 3d, she is to the west of the second of the Virgin; thus heading the five stars in triangle. She directs her course between the second of the Lion, and the second of the Virgin, and nearest to the latter star, but she does not pass the line between them before she sets. On the 4th, she is in the triangle formed by the five stars of the Virgin, being above the line between the seventh and third of this constellation, at first nearest to the former star. She is directing her course above the first, the nautical star, now at some distance to the east of her. On the 5th, she is to the east of the five stars in triangle of the Virgin, having below her the nautical star the first, which she does not pass before she sets. On the 6th, she is above the first of the Virgin, now to the west of her, and directing her course above the tenth and eleventh of this constellation, which she does not pass till after moon-set. On the 7th, she is above the first of the Balance, but she does not pass the line between this star and the second till after moon-set.

On the 8th, the Moon is on the meridian at eighteen minutes past eight in the evening, being between the third and seventh of the Balance. The former star she passed at three minutes past seven; and the latter star suffers an occultation at forty-three minutes past eleven. On immersion, the star is ten minutes forty seconds south of the Moon's centre, and it emerges at thirty-three minutes past midnight, being then ten minutes forty seconds south of the centre. On the 9th, the Moon is at three minutes past nine on the meridian; having almost directly under her the nautical star Antares; and below her, to the west, the second of the Scorpion: she is directing her course to the twelfth of the Archer. On the 10th, she is on the meridian at fifty minutes past nine; having now below her, to the west, Antares, and at a much greater distance to the east, the small stars in the head of the Archer and Saturn. On the 11th, she is on the meridian at thirty-nine minutes past ten; and, before she sets, two occultations take place; the first is of the first twelfth of the Archer, which is covered by the eastern limb of the Moon, at fifty-eight minutes and a quarter past ten; the star being eight minutes and three quarters south of the centre, and it emerges at seven minutes and forty seconds past midnight, the star being then seven minutes and a quarter south of the centre. The two small stars called the twelfths of the Archer, are so near to each other, that, on the occultation of the one, we naturally look for a similar occurrence with respect to the other; and, in fact, the second twelfth suffers an occultation before that of the first is over. This commences at three minutes and a half past midnight, the star being twelve minutes north of the centre, and it ends at fifty minutes and a half past midnight, the star being twelve minutes and twenty seconds north of the centre.

On the 12th, she is on the meridian at twenty-eight minutes past eleven, being in the head of the Archer, having Saturn below her, a little to the east, whom she passes about sun-rise. To the east of her is the sixteenth of the Archer, which, lying so directly in her course, must suffer an occultation. This takes place within an hour and a half from her being on the meridian, as the star is touched, by her eastern limb, at fifty-one minutes and forty seconds past midnight, being then four minutes and twenty seconds south of the centre; and it is covered till six minutes and a quarter past two in the morning, emerging at the distance of four minutes and ten seconds south of the centre.

On the 13th is full Moon, at twenty-four minutes past two in the afternoon, but without an eclipse, as she is above a degree and three quarters north of the eclipticK. In the evening she rises soon after Saturn, and the two first stars of the Goat; being between them and the planet; and her recess from the planet, and progress to a point under the two stars, may amuse the evening traveller, who will notice, also, Mars, on the opposite side to her from Saturn. On the 14th, she rises under the two first stars of the Goat, Saturn being considerably to the west of her; and Mars follows her, but not for some time. In her progress, she covers a small star, called the numerical nineteenth of the Goat; the occultation taking place at nearly ten minutes past midnight; the star being then twelve minutes north of the centre, and ending at nearly fifty-six minutes and three quarters past midnight; the star being twelve minutes and three quarters north of the centre. On the 15th, she rises nearly at the same time with Mars, now to the west of her. Under her are the small stars in the tail of the Goat. In the morning she passes the ecliptick in her descending node; but, for obvious reasons, without an eclipse. On the 16th, she rises under the first of the Water-bearer, Mars being now considerably to the west of her. On the 17th, she rises under the four small stars in triangle of the Water-pot, the four stars in square being above her to the east; but she has passed the line drawn through the two western of these stars and produced. On the 18th, she rises under the four stars in square; and at midnight is almost directly in the line with the two eastern of these stars. On the 19th, she rises under the four stars in square, almost in a line with the second and third of Pegasus, the highest and lowest of these stars. On the 20th, she rises under the four stars in square, but nearer to the three first stars of the Ram. On the 21st, she rises under the three first stars of the Ram; and, during the morning of the 22d, is perceived between the nautical star of this constellation and the first of the Whale, but nearest to the latter star, as she passes near the first sixteenth of the Whale at twenty minutes past four.

On the 23d, the Moon rises in the morning under the Pleiades, directing her course through the Hyades. On the 24th, she rises soon after Aldebaran, who is now to the west of her. On the 25th, she rises under the horns of the Bull; and on the 27th is new Moon, at forty-three minutes past two in the afternoon; at which time there is an eclipse of the Sun, not visible to the inhabitants of this island. The Sun is centrally eclipsed on the meridian, at nearly two minutes before three in that part of the earth, whose longitude is forty-four degrees thirty-four minutes west, and latitude seventeen degrees and fifty minutes south. On the 28th, she passes the ecliptick, in her ascending node, very early in the morning.

Mercury is an evening planet, being at his greatest elongation on the 31st; but being then in the sixth, an unfavourable sign, at setting, and with a southern latitude; he is only between seven and eight degrees above the horizon at sunset. Notwithstanding the brightness of the sky, the keen astronomer will see him, soon after, in west-by-north. In the early part of the month he is too near the Sun. His motion is direct from a point under the second of the Twins, to one about eight degrees east of the Lion. The Moon passes him on the 29th.

Venus is an evening star, within a degree of Mercury, on the 1st, and with him, then, too near the Sun to be visible; and, during the whole month, nearer to the Sun than he is. Consequently, nothing but her superior brightness will bring her to the notice of any one. On the last of the month, she is only between seven and eight degrees above the horizon at sun-set; being then a little more than a degree above the first of the Lion. Her motion to this point is direct through twenty-seven degrees. On the 22d, she is in conjunction with Jupiter, the distance between them being only three quarters of a degree, Venus being to the north; and they who have a good aspect to the west-north-west, may see them, soon after sun-set, near the horizon. The Moon passes her on the 28th.

Mars is on the meridian at nearly half past two on the morning of the 1st, and at one on the 20th. His motion is retrograde through five degrees and a quarter, in the constellation of the Goat; having above him on the 1st, when on the meridian, the four small stars in the tail of the Goat to the east; and, at a much greater distance, the two first stars to the west. His latitude is then five degrees five minutes south, and daily, but slowly, increasing; but, in his slow motion, he recedes from the small stars in the tail, and his distance from the two first diminishes. Saturn is considerably to the west of him. The Moon passes him on the 15th.

Jupiter is an evening star, and will at first be seen, after sun-set, near the horizon, in west-north-west; but the Sun gains upon him every day; so that he will soon be lost in the superior splendour of its beams. His motion is direct through six degrees and a half, in the barren space between the Crab and the Lion; in the middle of which, Venus passes him. The Moon passes him on the 28th.

Saturn is on the meridian at nearly half an hour before one in the morning of the 1st, and at eleven minutes past eleven at night of the 19th. His motion is retrograde through two degrees and a quarter, being to the east of, and near to the small stars in the head of the Archer, the whole month. The Moon passes him on the 13th.

Herschell is on the meridian at three quarters past eight in the evening of the 1st, and at twenty-four minutes past seven on the 19th. His motion is retrograde through nearly half a degree. The tenth of the Balance is a sufficient direction to him, as he is within a degree of this star to the west of it; and, when he is on the meridian, the second of the Scorpion is to the east of him; and to the west of him, at a greater distance, the two first of the Balance. Herschell, the tenth, the eleventh of the Balance, and the second of the Scorpion, are nearly in a line, in the order mentioned, from west to east. The Moon passes him on the 8th.

The apparent diameter of the Sun, on the 1st, is thirty-one minutes thirty-one seconds; and, on the 22d, thirty-one minutes thirty-three seconds. The apparent diameter of the Moon first decreases, then increases, and lastly decreases. At noon, on the 1st, it is thirty-one minutes forty seconds; at midnight, on the 8th, twenty-nine minutes thirty-two seconds; of the 24th, thirty-two minutes forty-two seconds; from which time it decreases to the end of the month; finishing with a magnitude of thirty minutes twenty-eight seconds.

The stars will be known, at any hour of the night, by consulting the volume for 1806, according to the following Table.

TABLE OF POSITIONS.

Pos.	1		8		16		25	
	h.	m.	h.	m.	h.	m.	h.	m.
VI.	8	47	8	18	7	46	7	10
VII.	10	47	10	18	9	46	9	10
VIII.	0	52	0	23	11	51	11	15
IX.	2	55	2	26	1	54	1	18
X.	4	50	4	21	3	49	3	13
XI.			6	22	5	50	5	14

AUGUST, 1813.

I HAVE observed, that Sir Isaac Newton's work, entitled Mathematical Principles of Natural Philosophy, can be read by very few. The author did not write them with the intention that they should be in general use; for he takes no pains to level his demonstrations to the capacities of common students; but, on the contrary, seems to take a pleasure in rendering every part almost of his work as difficult and intricate as possible. Many years, of course, elapsed before it was understood by any but the first-rate mathematicians; and a few of these gentlemen, in different parts of Europe, amused themselves by setting each other difficult problems; and exulting in the triumphs of their own sagacity.

When Newton's work came out, they, who had been accustomed to the regular demonstrations of the antients, were, for a time, shocked with his preliminary propositions contained in the first section; which, as now explained, may certainly be admitted: but the first proposition itself, without that explanation, vies in obscurity and palpable absurdity with his definition of numbers. Quantities, he says, which are constantly approaching to equality, in a certain time, and before the end of that time, are nearer to equality than by any assignable difference, become, ultimately, equal. Now, equality is a simple idea, admitting of no modification. If we compare quantities together of any kinds, they are either equal or unequal: and, if a writer says of two quantities, that they become equal at last, it follows, that these quantities are equal.

To say that two quantities are equal, when both cease to exist, is idle; for equality belongs only to quantities determinate: if they are quantities of extension, they are determinate in length, breadth, thickness, in one or two, or all three of these dimensions. Who is there, that does not know, that it will take more time in walking from one corner of a square to the opposite corner, than in walking along one of the sides? This is obvious to common sense; yet it was long before the exact relation of the cross line to that of the side was known. A tale is told, that we owe the discovery of this relation to Pythagoras, who offered, on this account, a hecatomb to the gods: but it is not probable, that a man of his principles should make this sacrifice; and the discovery, we may rather imagine, was made, long before his time, in the east.

If, instead of the corner, you go from any point in the side of a square to the opposite corner, you will be longer in walking it, than in going along the square; and it matters not how near you take your point to the corner; the distance between that point and the opposite corner must be always greater than the side of the square. But, in Newton's Mathematics, this demonstrated truth is contravened by his notion of ultimate equality; and he does not scruple to say, that the two lines we have been mentioning, which can never be equal, are ultimately equal. As we observed before, the notion of equality is well understood; and when we say, that two lines are equal, a common measure may be applied to both, which will exactly measure them.

How, then, it may be asked, could such a palpable absurdity be admitted, and receive the countenance of men of distinguished abilities? How could they consent to allow, as a sufficient basis for a whole system of philosophy, what is contrary to demonstration? In cases where the human mind is led into palpable errour, we shall generally find, that it has been deceived by some semblance of truth, by some disguise, which carries it away from examining, with sufficient attention, the thing proposed for its assent. Newton begins by modifying what cannot be modified, namely, the notion of equality. The reader is startled, at first, at such an assumption; he is puzzled by a pretended demonstration, in which there is a complete confusion of ideas; he begins to think that he misapprehends the author; and, finding that men of eminence have assented to the proposition, he begins to reconcile together, as well as he can, the new notion with the old notion of equality; then he finds them both compatible; and at last he is surprised, that every one should not see as clearly into the mystery as he does; and is now prepared to talk of quantities less than nothing, and to compare together others, of a different nature, which he calls impossible.

Newton has endeavoured to reconcile us to his notions by a pleasant instance, which, he says, makes the thing very clear *. Thus, suppose two horses to set off together, one being twenty rods before the other, and let them be supposed to go on, at the same rate, for some thousands of years; or, if you please, some thousands of thousands of years; in short, never to stop. Then, he says, the last proportion of the distances they have gone over, will be that of equality. But if they are never to stop, where will be the last proportion? and, during their progress, the proportion of the distances is always unequal. It is approaching always to, but it never arrives at that of equality. We may, in a large account, throw out the pence and farthings, but the bill remains the same, and the money paid does not amount to that of the bill, unless it is paid to the very

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* See the scholium, at the end of the first section of the Principia:—"Res clarius intelligatur in infinite "magnis. Si quantitates duæ, quarum data est dif-"ferentia augeantur in infinitum, dabitur harum ulti-"ma ratio nimirum ratio equalitis." In English:—"We shall understand these things better, by consider-"ing infinitely great quantities. If two quantities, "differing by a certain magnitude, should be increased "for ever, their last proportion will be that of equa-"lity." By the way, a quantity infinitely great, is an absurdity. All quantity is finite.

farthing. So, in the instance above, the difference of the distances may be considered as so trifling, that, when they are very large, the proportion between them may be considered as that of equality; but we are not justified in saying, that it is at last that of equality.

The Moon is seen, in the evening of the 1st, soon after sun-set, in the west-south-west, to the west of the nautical star the first of the Virgin, having, to the west of her, the five stars in triangle of this constellation, being above, and nearest to the third, the star in the vertex of the angle. On the 2d, she is above, and a little to the east of the first of the Virgin; directing her course above the tenth and eleventh of this constellation, at some distance from her to the east. On the 3d, she is seen to have passed the tenth and eleventh of the Virgin, as she is receding from them to pass between the two first stars of the Balance, directing her course to the third of this latter constellation. On the 4th, she is seen to have passed the two first stars of the Balance, and to be nearing to the third of the Balance; but she does not pass it till after she has set. On the 5th, she is seen above the second of the Scorpion; and her progress by this star will be noticed during the evening. Under her, to the east, the nautical star, the first of the Scorpion, will call our attention.

On the 6th, the Moon is on the meridian at forty-three minutes past seven; having below her, to the west, and at some distance, Antares. On the 7th, she is on the meridian at thirty-one minutes past eight, Antares being now at a considerable distance to the west of her, and Saturn rather nearer to the east of her. On the 8th, she is on the meridian at twenty-one minutes past nine, Saturn being to the east of her; the small stars in the head of the Archer being between them. On the 9th, she is on the meridian at twelve minutes past ten, Saturn being now below her to the west, and the two first stars of the Goat above her to the east, with Mars under her. On the 10th, she is on the meridian at three minutes past eleven; the two first stars of the Goat being now above her, near to the meridian on the west, and Saturn considerably to the west of her, and Mars almost directly below her. On the 11th, she is on the meridian at fifty-five minutes past eleven; having under her, but a little to the east of the meridian, the four small stars in the Goat, Mars being now at some distance below her to the west. On this day she passes the ecliptick, in her descending node, a little before noon, and before she sets she suffers an eclipse. This takes place in the morning of the 12th, beginning at forty minutes and a half past one, and ending at fifty-four minutes and three quarters past three; the digits eclipsed being on the northern limb four degrees twenty-five minutes.

At night, on the 12th, the Moon rises to the east of the small stars in the tail of the Goat; and is perceived to be travelling below, but at a considerable distance from the first of the Waterbearer, and the four small stars in triangle of the Waterpot. On the 13th, she rises under the four stars in triangle of the Waterpot, whose stream she is entering; and in her passage through it covers the star called first twenty-third of the Waterbearer, or 1 ψ ♒. The occultation takes place at five minutes past eleven; the star being twelve minutes and three quarters south of the Moon's centre, and ends at forty-eight minutes and a half past eleven; the star being then twelve minutes and a half south of the centre. At nine minutes past midnight, she passes the second twenty-third, 2 ψ ♒.

On the 14th, she rises in the space between the lines drawn through the four stars in square and produced. On the 15th, she is to the east of the line drawn through the two eastern of the four stars in square. On the 16th, she is seen to be directing her course between the stars in the heads of the Ram and the Whale, having passed the thirteenth of the Fishes at a quarter past seven. On the 17th, she is seen between the first of the Ram and the first of the Whale, but nearer to the latter star, passing the twelfth, in its constellation, at seven minutes past eleven at night. On the 18th, she is seen between the first of the Whale and Aldebaran, but nearer to the former star, as she passes the star called *f* in the Bull, at fifty-two minutes past six in the evening. On the 19th, she is seen near to Aldebaran, as she passes this star at nine minutes past ten in the evening. On the 20th, she rises under the tip of the southern horn of the Bull; and, by her motion during the morning of the 21st, will be perceived to direct her course towards the thirteenth of the Twins.

On the 22d, the Moon rises in the morning to the east of the thirteenth of the Twins; the seventh and twelfth being at some distance above her. On the 23d, she rises below the two first stars of the Twins, and passes the line between the nautical star and the first of the Lesser Dog. On the 24th, she passes the ecliptick, in her ascending node, between ten and eleven in the morning; but, for obvious reasons, without an eclipse: and on the 26th is new Moon, at eight minutes past one in the morning; but without an eclipse, as she is nearly two degrees in latitude north of the ecliptick.

On the 28th, the crescent of the Moon is seen in the evening in the west, being near to the third of the Virgin, having thus the five stars in triangle to the west of her. On the 29th, she is seen above the first or nautical star of the Virgin. On the 30th, she is above the tenth and eleventh of the Virgin; and on the 31st she is perceived to have passed the line between the first and second of the Balance; being, at her first appearance, a little to the east of the middle of that line.

Mercury is stationary on the 14th, and in his inferior conjunction on the 27th; but his latitude is southern and increasing; and his sign, the sixth, is unfavourable. On the 1st, he is, at sun-set, only six degrees above the horizon in the west; and though the brilliancy of the sky diminishes, he cannot overcome it, in the small distance he has to go to the horizon; and as he cannot do this at first, he cannot afterwards, as he every day is more and more overcome by the superior splendour of the Sun. The Moon passes him on the 26th.

Venus is an evening star, nearer, at first, to the Sun than Mercury, and, of course, not visible; but though her distance from the Sun daily increases, yet the part of the zodiack in which she is highly unfavourable, being the sixth sign, and a small part in each of the signs the fifth and the seventh. Her motion is direct through thirty-seven degrees, being, on the 1st, just above the first of the Lion; and she travels from this star to the second of the Virgin; which, on her passage by it, on the 23d, is twenty-seven minutes and a half to the south of her; thence she proceeds to the seventh of the Virgin, being twenty-five minutes to the north of this star on the 29th, when she passes by it; and she proceeds only about two degrees beyond it. In this whole course, two unfavourable circumstances attend her, namely, that, as her distance from the Sun increases, her latitude, which is north, decreases; and the unfavourableness of the sign increases. On the 1st, her height above the horizon, at sun-set, is not seven degrees, and it continues at nearly this height the whole month *. The Moon passes her on the 28th.

Mars is on the meridian at fifty-nine minutes past eleven on the night of the 1st, and at nine minutes past ten, on the 25th. On the 29th, he is stationary, his motion being retrograde to that time, from a point to the east of the two first stars of the Goat, to a point almost directly under them, through a space of somewhat more than five degrees. He is, during this time, at a great distance from the ecliptick, his latitude being south, at first six degrees forty-two minutes, and at the end nearly six degrees. The evenings, at nine or ten, will be very favourable for observing Mars and Saturn: towards the end of the month

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* I wish the instructers of youth to point out particularly to their pupils the nature of this phœnomenon. The motion of Venus, this month, is peculiarly adapted to this purpose, and may be shewn, to great advantage, on the globe.

they will be at opposite sides of the meridian at nearly equal distances from it. The Moon passes Mars on the 11th.

Saturn is on the meridian at sixteen minutes past ten at night, on the 1st; and at four minutes past nine, on the 19th. His motion is retrograde through somewhat more than a degree and a half under the sixteenth of the Archer, the most western of the stars in his head; and Saturn is about a quarter of a degree of latitude north of the ecliptick. The Moon passes him on the 9th.

Herschell is on the meridian at forty minutes past six in the evening of the 1st, and every evening later; so that the opportunities of seeing him daily diminish. He is stationary on the 5th; after which his motion is direct, through somewhat more than twenty minutes towards the tenth of the Balance, which continues to be an excellent guide to this planet.

The apparent diameter of the Sun is, on the the 1st, thirty-one minutes thirty-five seconds; and, on the 19th, thirty-one minutes forty-one seconds. The apparent diameter of the Moon first decreases, then increases, and lastly decreases. On the 1st, at noon, it is thirty-one minutes eighteen seconds; on the 5th, twenty-nine minutes thirty-six seconds; on the 20th, thirty-two minutes twenty-two seconds; and at the end of the month twenty-nine minutes forty seconds.

The places of the fixed stars, at any hour of the night, may be known by consulting the volume for 1806, according to the following Table of Positions.

TABLE OF POSITIONS.

Pos.	1		8		16		25	
	h.	m.	h.	m.	h.	m.	h.	m.
VII.	8	42	8	15	7	45	7	12
VIII.	10	47	10	20	9	50	9	17
IX.	0	50	0	23	11	53	11	20
X.	2	45	2	18	1	48	1	15
XI.	4	46	4	19	3	49	3	16
XII.					5	55	5	22

SEPTEMBER, 1813.

AM I endeavouring to overthrow the mathematicks and the philosophy of Sir Isaac Newton? By no means. In both there is much of good; and we are indebted to our great countryman, as we are to many great men of other ages and nations, for their diligent researches and patient investigations. But none of them are infallible; and the greatness of their names must not be made a cover for any errour in their reasoning, or any position, which a future age may overthrow. It is better to proceed slowly and cautiously, than to advance one step in philosophy beyond the strict bounds of absolute demonstration. We must be careful to keep the limits distinct between conjecture and certainty.

I will take a familiar instance, which occurs to us every day. Every one knows, that a piece of sugar, put into his tea-cup, dissolves and communicates a sweetness to the liquor contained in it. How is this done? In this manner, says a philosopher:—The particles of water are endued with the power of attraction; the particles of sugar are also endued with a power of attraction. The water nearest to the sugar is thus affected by the mutual action of the one upon the other; and so, in succession, till ever particle of water is combined with its particle of sugar; which being thus split into very minute parts, the whole liquor becomes transparent. To render this action of the one upon the other quicker, we stir the sugar about in the water, and the solution is the sooner made. That every particle of water has its particle of sugar, is evident; because you cannot take up a single drop, without perceiving by the tongue a sweetness, which the water had not before the sugar was put into it.

The explanation seems very clear; and if we can believe that particles have this attractive power, no difficulty remains in adopting it. As the particles of water attract those of sugar, so the particles of another fluid may attract those of metal: as, for example, the particles of aqua regia attract the particles of gold; and hence, a solution of gold will be made in aqua regia in the same manner as one of sugar in common water. Farther, as the particles of matter attract each other, the particles of one kind of matter will attract those of another kind more than they do those of a third: and hence, if a solution is made by a solid and a fluid, the putting in of another fluid may detach the solid from the first fluid; for the two fluids run into each other's arms, and the poor solid is thrust down to the bottom. This is, in fact, the theory of the modern chymistry.

Facts innumerable are brought to attest the truth of this theory. Solids are dropped in fluids, fluids on solids, and fluids are mixed together. Solutions and precipitations are thus effected. We acknowledge the facts; the manner in which they are performed may be a question of great difficulty. The case of a lump of sugar in water, if properly explained, would lead us to the knowledge of what takes place in other solutions; and, as the experiment is so easy, it may amuse you to make it with more attention than you have hitherto done: and, for this purpose, take a glass of hot water, and let fall a lump of sugar into it, and observe the result.

From the lump of sugar, you perceive, issues a quantity of bubbles, which rush, with great quickness, to the surface of the water, and there burst.* If you take a magnifying glass, you will perceive, that the sugar presents a very rough appearance, with large caverns and lofty precipices. The water, entering the pores, throws down the craggy rocks, of which fragments are carried by bubbles to the surface; whence they seem to be driven back, with great force, and crumble in their fall. The work of ruin and desolation goes on with great rapidity, till the lump lies, in detached fragments, at the bottom; which, on being stirred, present accumulated bubbles; and the progress goes on till the whole appears to be destroyed. If the water is cold, the process is much longer, but the effect is the same.

Now, supposing that you had never seen a piece of sugar melting in water, and had, previously to its being put into it, been told, that the water next to it would, by attraction, detach pieces from it till the whole was dissolved, in what manner should you have imagined, that the process would go on? Does this formation of bubbles, this rush upwards, agree with the notion of the mutual attraction of the particles of sugar and the particles of water nearest to it? Common as is the experiment, and general as is the explanation of it, I leave you to ponder on your answer; and proceed now to the appearances of bodies in the heavens.

On the 1st, the Moon is perceived in the evening, on the appearance of the stars, to be under the twenty-third of the Balance, and above the third and seventh of this constellation; the first and second being now at a considerable distance to the west of her; and the second and first of the Scorpion under her to the east. She passes the twenty-third of the Balance, at twenty-three minutes past nine. On the 2d, she is seen, above the second and first of the Scorpion, both stars being to the west of, though the latter is almost directly under her, though at some distance. She is directing her course towards Saturn, considerably to the east of her. On the 3d, she is on the meridian at twenty-nine minutes past six; having, to the west of her, the first and second of the Scorpion, and, at a greater distance to the east, Saturn, with the small stars in the head of the Archer. Directly above her, at a great height, are the first of Hercules, and first of the Serpent-bearer, occupying opposite sides of the meridian. On the 4th, she is on the meridian at eighteen minutes past seven, being to the east of the twelfth of the Archer, the small stars in its head being, with Saturn, at some distance to the east of her. The eleventh of the Archer is almost directly under her. On the 5th, she is on the meridian, at eight minntes past eight, having near to her, but now to the west, Saturn, with the small stars in the head of the Archer; and, at some distance to the east of her, the two first stars of the Goat, with Mars. On the 6th, she is on the meridian at fifty-nine minutes past eight, the two first stars of the Goat being above her, and Mars at a greater distance below her, to the east of the meridian. Saturn is now at a considerable distance to the west of her. On the 7th, she is on the meridian at fifty-one minutes past nine; the two first stars of the Goat, with Mars, being now at some distance from her to the west. The planet being nearly in a line with the two stars, though at some distance from them, forms, with the Moon, a very pleasing object. On this evening, she passes the ecliptick in her descending node; but, for obvious reasons, without an eclipse: and she is nearly in the middle space between the two first and the small stars in the tail of the Goat.

On the 8th, the Moon is on the meridian at forty-three minutes past ten, being now to the east of the small stars in the tail of the Goat, and having above her the two first of the Water-bearer; the first near to the meridian on the east, the second at a greater distance to the west of it. Mars is now at some distance below her to the west. On the 9th, she is on the meridian at thirty-four minutes past eleven; being now very near the line drawn through the two eastern of the four stars in square and Fomalhaut; the former being high above her, and the latter near the horizon; but all three near to the meridian on the east. On the 10th, is full Moon, at thirteen minutes past two in the afternooon, but without an eclipse, as she is upwards of three degrees south of the ecliptick. During the night, we perceive her travelling in the space between the lines drawn through the two western and two eastern of the four stars in square and produced; but she does not reach the eastern boundary.

On the 11th, the Moon rises under the four stars in square, being to the east of the line drawn through the two eastern stars. On the 12th, she rises under the small stars in the band of the Fishes to the west of the twelfth; passing the thirteenth about two hours after midnight. During the evening we notice, above her to the east, the nautical star, the first of the Ram. On the 13th, she rises under the three first stars of the Ram; and, soon after, passing over the second fourteenth of the Whale. This star suffers an occultation at fifty-nine minutes past eight, being then ten minutes north of the centre; and it emerges at forty-four minutes past nine, being then nine minutes north of the centre. She is directing her course to the twelfth of the Whale; the uppermost of the three small stars in its head; below which is the first, and she passes the twelfth a little before sun-rise. On the 14th, she rises under the three first stars of the Ram, now to the west of her; and about midnight, is near the line between the first of the Whale and the Pleiades. At forty-one minutes past eleven at night, the small star called *f*, in the Bull, suffers an occultation, the star being three minutes forty seconds south of the centre, and ends at forty minutes past midnight, the star being then seven minutes and a half south of the centre. On the 15th, she rises under the Pleiades; and, during the night, we observe her course through the Hyades. She passes the third of the Bull, the most western of them, at one minute past nine, the first fourth at forty-eight minutes past ten, the second fourth at fourteen minutes past eleven, and Aldebaran at nearly three hours and three quarters past midnight; and her approaches, therefore, to this nautical star will sufficiently point it out to every observer. On the 16th, she rises considerably to the east of Aldebaran, directing her course under the sixth of the Bull to the thirteenth of the Twins. On the 17th, she rises under the seventh and twelfth of the Twins, the thirteenth being to the east of her, but so near, that she passes it at an hour and thirty-five minutes past midnight. On the 18th, she rises under the fourth of the Twins; and, during the morning of the 19th, we notice above her the two first stars of the Twins; the second, the nautical star, being the nearest to her.

On the 20th, the Moon rises in the morning, under and almost in a line with the two first stars of the Twins. She is directing her course to the first of the Lion, and Jupiter is to be seen, before sun-set, to the east of her. On this day, she passes the ecliptick in her ascending node between three and four in the morning; but, for obvious reasons, without an eclipse. On the 21st, she is seen in the barren space between the Crab and the Lion; the first of the latter constellation and Jupiter being marked objects to the east of her, after they are risen. On the 22d, she rises under the first of the Lion, and forms, with this star and Jupiter, a groupe that will be noticed; for she passed the star only at twenty-three minutes past eleven of the last night; and she passes Jupiter at forty-three minutes past one of this morning. On the 24th is new Moon, at eleven minutes past two of the afternoon, but without an eclipse, as she is about four degrees north of the ecliptick at this time.

On the 26th, the crescent of the Moon will be seen, soon after sun-set, near the horizon, in the west-south-west, being above the first of the Virgin, and to the east of that star: to the east of her, is Venus, above whom she is directing her course. On the 27th, she is seen to the west of the line drawn through the two first stars of the Balance, and nearest to the first star, and it is evident that she will have passed this line long before we see her again. Below her, to the west, Venus, as an evening star, attracts our notice. On the 28th, she is seen considerably to the east of the two first stars of the Balance, as, at forty-three minutes past six, she passes the third, and at fourteen minutes past eleven, the seventh of this constellation. On the 29th, she has below her, to the west, the second of the Scorpion, and at a greater distance, and to the east, Antares. She is directing her course to Saturn, at a great distance from her, to the east. On the 30th, she is under the seventh of Hercules, the two first stars of the Scorpion being at some distance from her to the west; and Saturn is so far removed, that it will take two days, at least, to reach him.

Mercury is a morning star, stationary on the 6th, and at his greatest elongation on the 13th. In the middle of the month he will be seen, by the early riser, in the east; for, on the day of his greatest elongation, he is above an hour and three quarters above the horizon before sun-rise. His motion is direct through thirty degrees, chiefly in the constellation of the Lion; being at first to the east of the first of the Lion, at about three degrees distant from him; and he finishes his course between the second and seventh of the Virgin, but nearest to the latter star. The Moon passes him on the 23d.

Venus is an evening star, in the seventh, an unfavourable sign, being on the 1st about eight degrees above the horizon at sun-set, and on the 31st, nearly at the same height. Her latitude is first north, and decreasing; and she passes the ecliptick in her descending node on the 21st; and then her southern latitude increases; so that though her distance from the Sun is daily increasing, yet that advantage is diminished by the unfavourable change in her latitude*. Her motion is direct through about thirty-six degrees; commencing from a point nearly three degrees and a half from the seventh of the Virgin to the east of it, and ending about a degree from the first of the Balance. In her way to this latter star, she passes the eleventh of the Virgin, on the 24th, the star being forty-four minutes from her to the north. The Moon passes her on the 27th.

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* This will be explained by the teacher of geography and astronomy to his pupils with a globe, and marks for the Sun and Venus, in their places, on several nights.

Mars is on the meridian at forty-two minutes past nine at night on the 1st, and at forty-seven minutes past eight, on the 19th; so that this month is very favourable to observations on this planet. His motion is direct through about six degrees, being at first under, and almost in a line with, the two first stars of the Goat; his distance from them, however, being very considerable, as his latitude is southern, and amounting to five degrees and three quarters. This is daily diminishing, but it does not go below four degrees till the end of the month. When he is on the meridian, we shall contrast with him Saturn, to the west of it; and these two planets will characterise the lower region of the southern sky, soon after sun-set. The Moon passes Mars on the 7th.

Jupiter is a morning star, near the Sun at first, but in a favourable position; so that his stay above the horizon before sun-rise, on the 1st, is an hour and twenty minutes, and this is constantly increasing. His motion is direct through nearly six degrees and a quarter, and nearly in the middle of this space is the first of the Lion, which star he passes on the 15th; the star being twenty minutes south of him. Towards the middle of the month, this planet, the first of the Lion, and Mercury, will form an interesting object to the keen astronomer, and will gratify the early riser, the star being between the two planets; and then the two planets will be visible, for some mornings, under it. Jupiter is then daily receding, and Mercury approaching to the Sun. The Moon passes Jupiter on the 22d.

Saturn is on the meridian at fourteen minutes past eight in the evening of the first, and at nine minutes past seven of the 19th. His motion is retrograde to the 16th, when he is stationary, and, consequently, after that time, direct, but so slow, that, to the common observer, he will not be perceived to change his place. He is under the small stars in the head of the

Archer, nearest to the fifteenth. To the east of him is Mars, receding daily, but slowly, from him. The Moon passes Saturn on the 5th.

Herschell is an evening star, affording, every day, less opportunity of seeing him to advantage. His motion is direct through somewhat more than a degree; and in this space is the tenth of the Balance, which star he passes on the 25th, being then eleven minutes north of it; Consequently, this star is an admirable guide to the planet: unfortunately, at the time of his passing it, he will be near to the horizon. On the 1st, however, we shall see him by directing our view, between seven and eight, to the south-west, where he is about ten degrees above the horizon; and the second of the Scorpion, to the east of him, will be our direction: to the west of which is the eleventh of the Balance; and, farther to the west, the tenth, near to which, on the west, is our planet. The Moon passes him on the 28th.

The Sun's apparent diameter on the 3d is thirty-one minutes forty-seven seconds; and on the

25th, thirty-one minutes fifty-nine seconds. The apparent diameter of the Moon is nearly stationary for the two first days, then increases, and decreases afterwards to the last day of the month, on which it again commences its increase. At first it is twenty-nine minutes thirty-six seconds; and on the 14th, it is thirty-two minutes thirty-four seconds: it then decreases; and at noon of the last day is twenty-nine minutes thirty-two seconds.

The situations of the fixed stars will be known by consulting the positions in the volume for 1806, according to the following Table.

TABLE OF POSITIONS.

Pos.	1		8		16		24	
	h.	m.	h.	m.	h.	m.	h.	m.
VII.	6	46	6	21	5	52		
VIII.	8	51	8	26	7	57	7	28
IX.	10	54	10	29	10	0	9	31
X.	0	49	0	24	11	55	11	26
XI.	2	50	2	25	1	56	1	27
XII.	4	56	4	31	4	2	3	33
I.	6	46	6	21	5	52	5	23

OCTOBER, 1813.

SOME objects evade our researches from their magnitude; others, from their minuteness; and others, from their remoteness. When we think of those diminutive beings, which are to be discovered only by a microscope, and yet, in possessing living powers, must be endued with something similar to our nerves, and muscles, and heart, we are at a loss to conceive, how such motions are compatible with such minuteness. When we contemplate the great extent over which a small piece of gold is diffused in gilt wire, we cannot doubt of the immense divisibility of matter. The smallest piece of gold wire that we can cut off, is still divisible into smaller pieces; and, if we try our conceptions to the utmost, we cannot speak positively of any piece of gold that can be esteemed to be the smallest particle of that metal.

In the same manner, when we speak of the particles of water and particles of sugar attracting each other, we speak of things to which we do not affix any definite idea. What is the form, what is the length, the breadth, the thickness, of these particles? Before we endue them with an attractive power, we should surely know, what it is we are talking of, in which this power exists. The Indian, who answered, firmly, for the first supporter of our earth, that it was an elephant, was satisfied, in his own mind, that he had given the enquirer an adequate cause. When he was asked, on what the elephant rested: an immense tortoise was competent to the work. But when he was pressed farther for a support to this tortoise, he found himself at a loss; and, satisfied with its immensity, gave himself no farther trouble about the subject *.

Are we, in these enlightened times, entirely free from a similar mode of reasoning? You have examined the melting of a piece of sugar in a glass of water. What do you now say of the cause? Is it, or is it not, done by attrac-

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* "——Quid rides? mutato nomine de te
"Fabula narratur."

tion? *i. e.* is the sugar diffused throughout the whole of the water, by being divided into particles, which are attached to particles of water, by a power residing in each, by which they draw each to the other? That the sugar is divided into very small parts, we easily see; and when these parts become too small to be distinguished by the eye, we can easily conceive that they are still farther divided, because the smallest quantity of water taken up is affected by sweetness. And that water may be divided into very small parts we know, by various facts, though we have no conception of the size and shape of the least particle, which, combined with a particle of sugar, can affect our taste.

Before we speak positively on this subject, should we not be fully acquainted with the matter in discussion? It might seem strange, if I should ask, what is water? and yet it may puzzle you to give a satisfactory account of this useful element. You remember the story of the king of Siam, who was told, by European travellers, that water became so hard in their country, that it would support an elephant. He was acquainted with water in two processes only of its existence, in its fluid state, and in that of steam; and the travellers did not give themselves the trouble of pointing out to his majesty what happens to other substances, and which might have solved this difficulty, and made it easy to his conception. The metals, they might have told him, are seen in a hard state, but they are brought from the ore by fusion, and they remain liquid at certain degrees of heat, and, in our temperature, are always solid. Quicksilver does not become solid but by an artificial cold far exceeding that known in the coldest regions; but it evaporates in a heat much less than that which converts water into steam.

From seeing the metals generally in a solid form, we speak of them, when in a fluid form, not by a different name, but as melted gold, melted silver, melted lead. Quicksilver, when it is hardened, is called solid quicksilver. But, if gold and silver were as commonly seen in our countries in a liquid form, and quicksilver in a solid form, as water is, under its two forms of solid and fluid, we should have names for the respective forms as appropriate to melted gold, as ice is to solid water, or steam to water evaporated. Water has its three names, because the appearances under which it exists are common: but is there an impropriety in considering ice as solid water? or would it be better to have a name for whatever it is in the water, which remains the same, when it becomes ice, or is converted into steam?

In this age for inventing names, a liberty of this kind will not be thought too great, when the subject seems to demand it; and, for the present purpose, I shall beg leave to use a term, which may keep us from errour in speaking of the attractive power of the particles of water. Permit me to call those particles hydatic*, which remain unaltered in the three stages of water, namely, in ice, water, and steam; and I would then ask, whether the hydatic particles have the power of attracting sugar? To determine this, the following experiment may be tried: — In a severe frost, take a quantity of powdered ice and an equal quantity of powdered sugar; shake them well together, and notice whether the particles of sugar are not easily distinguished from those of ice. After they have been well shaken together, bring them in a glass, and set it before the fire, and observe the process of the solution.

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* The scholar will at once perceive the propriety of the term hydatic, from its connection with the Greek word for water.

I apprehend, that a loaf of sugar might lay for ages on an island of ice, as long as the temperature of the air was ten degrees under the freezing point, yet the attractive powers of the hydatic particles would not avail to detach a single particle of the sugar from the lump.

If the hydatic particles in ice have not the attractive power attributed to them in water, we must attribute the connection between them and those of sugar, when it is melted in water, to something with which the hydatic particles are united in the state of water. This something is not easily to be explored; yet there are facts, which may gradually lead mankind to the discovery of it. When ice is converted into water, slowly, the water is said to be very cold, and, by applying fire to it, it gradually grows warmer and warmer, till it arrives to the point of boiling heat, when it evaporates into steam. By growing warmer and warmer, we mean, that the hydatic particles become more and more combined with the substance of heat, whatever that substance may be, till, being completely saturated with it, they are carried away by an over abundancy of heat, in the form of steam. In this process it is found, that sugar is dissolved when the water is cold very slowly, but with greater rapidity the hotter the water is made. Are we not, therefore, to conclude, that what we call attraction between the particles of sugar and water, is really a combination of hydatic particles, sugary particles, and particles of heat, and that the hydatic do not attract the sugary? We must look for their union in the nature of heat; and how that operates, I leave to your conjecture. The business of the month now calls us to the contemplation of other objects.

On the 1st of this month, the Moon is seen in the evening, after sun-set, in south-south-west, to the west of the two twelfths of the Archer, Saturn being considerably to the east of her; the stars she does not pass till after she has set. To the west of her, near the horizon, we notice Venus and the first of the Balance. On the 2d, she is on the meridian at eight minutes past six in the evening, just entering the head of the Archer on the west, passing the fifteenth of this constellation at twenty-three minutes past eleven, that is, after moon-set. It is evident that she will have passed Saturn before her next appearance; and her course is directed between Mars and the two first stars of the Goat, at a considerable distance from her to the east. On the

3d, she is on the meridian at fifty-eight minutes past six, Saturn being now below her to the west, and Mars at a greater distance to the east. Above her, to the east, are the two first stars of the Goat. On the 4th, she is on the meridian at forty-nine minutes past seven, having to the west, above her, the two first stars of the Goat; and below her Mars, to the east. Saturn is now at a considerable distance from her to the west. On the 5th, she passes the eclíptick, in her descending node, about two in the morning; but, for obvious reasons, without an eclipse: in the evening, she is on the meridian at forty minutes past eight, having below, and near to her to the east, the four small stars in the tail of the Goat, the two first being at some distance to the west of her. Mars is now also below her to the west. On the 6th, she is on the meridian at thirty-one minutes past nine, being under the first of the Waterbearer, and the four small stars in triangle of the Waterpot, the former to the west, the latter to the east of the meridian. On the 7th, she is on the meridian at twenty-two minutes past ten, being now under the four stars in square, the two western of these stars being near to the meridian on the west; and, consequently, the nautical star the first of Pegasus, being almost directly over her, and the nearest of the four stars to her. To the west of and near to her are the small stars in the stream of the Waterpot, called the twenty-thirds. The first of them she covered before sun-set; and it did not emerge till fifty-three minutes past five; being then eight minutes south of the centre; and she passed the second twenty-third at thirty-five minutes past six. On the 8th, she is on the meridian at fourteen minutes past eleven, being under the two eastern of the four stars in square, which are near to the meridian on the west.

On the 9th, she rises under the four stars in square, not to be distinguished from a full Moon, which she becomes half an hour after her passage over the meridian at midnight. There is, however, no eclipse, as she is nearly four degrees and three quarters south of the ecliptick. On the 10th, she rises below the line between the four stars in square and the three first of the Ram, but nearest to the latter stars. On the 11th, she rises under the three first stars of the Ram. On the 12th, she rises under the Pleiades; and is seen to be directing her course through the Hyades; as she passes them before moon-set, namely, on the 13th, in the morning, at thirteen minutes past four, the third of the Bull; at fifty-seven minutes past five, the first fourth; and at twenty-two minutes past six, the second fourth. The nautical star Aldebaran will be noticed in her progress towards it. In the evening she rises after this star, to the east of it, having passed it about noon. On the 14th, she rises under the sixth of the Bull, or tip of the southern horn, directing her course to the sixth of the Twins; as we shall see when this star has been some time risen. She does not, however, pass the seventh and fourteenth till after midnight. On the 15th, she rises under but near to the sixth of the Twins, as she passed this star at twenty-six minutes past nine at night; we shall, therefore, during the night, notice the two first of the Twins; the second, or nautical star, being the nearest to her. On the 16th, she rises under the two first stars in the Twins, and almost in a line with them. Consequently, the nautical star, being nearest to her, will be distinguished. On the 17th, she passes the eclíptick in her ascending node in the evening; for obvious reasons, without an eclipse. Near midnight, she rises under the Nebula of the Crab; and during the morning of the 18th, will be seen in the barren space between this constellation and the Lion; the first star of which, with Jupiter, will attract our attention.

On the 19th, the Moon rises in the morning, and is soon followed by the first of the Lion and Jupiter, as she passes the star at fourteen minutes past five, and the planet in the afternoon. These three objects will, therefore, attract the attention of the traveller. On the 20th, she rises under Jupiter, who is nearer to her than to the first of the Lion above him. On the 21st, she is followed, soon after her rising, by the second of the Virgin, and thus heads the five stars in triangle of this constellation; and on the 24th is new Moon, at fifty-six minutes past five in the morning; but, for obvious reasons, without an eclipse.

On the 26th, the crescent of the Moon is seen in the evening in the south-west; having below her the second of the Scorpion; and to the east of her Venus, whom she will pass at her next appearance. On the 27th, she is seen above Venus. They are at opposite sides of the eclip-tick; and neither will gladden us long. The planet will, of course, first disappear. On the 28th, she is perceived to have receded considerably from Venus, and to be directing her course towards Saturn. On the 29th, she is still between Venus and Saturn, but nearest to the latter planet. On the 30th, Saturn is below her, and Mars calls our attention to the east of her; and on the 31st, she is on the meridian at three quarters past five; having, above her, the two first stars of the Goat; to the east of her, Mars; to the west, Saturn and Venus, the latter being near to the horizon, to the south of south-west.

Mercury is in his superior conjunction on the 9th, and during the whole month so near the Sun, that he will be detected only by the very keen astronomer. The Moon passes him on the 25th.

Venus is an evening planet in an unfavourable position. On the 1st, she is seen in the lower part of the lower region at sun-set, in south-west-by-west, distant only fifty-six minutes and a half from the first of the Balance, the star being north of her. From this place she travels with a direct motion, but an increasing southern latitude, through twenty-seven degrees. On the 6th, she passes the ninth of this constellation, being fifty-nine minutes from the small star near to it, and to the north of it, directing her course to the fourth of the Scorpion, which she passes on the 16th, the star being thirty-seven minutes south of her. Her passage by Antares would gratify us, if the star were not so near the horizon at sun-set; and she ends her course near the eighth of the Serpent-bearer, passing it on the last day of the month, at the distance of fourteen minutes, the star being north of her. The Moon passes her on the 27th.

Mars is on the meridian at eighteen minutes past eight in the evening of the 1st; and forty-three minutes past seven, of the 19th. His motion is direct through fifteen degrees. On the 1st, when on the meridian, the two first stars of the Goat are at some distance above him to the west of the meridian; and he directs his course to the small stars in the tail of this constellation. These he reaches on the 24th, passing on that day the third of the Goat, at the distance of only two minutes, the star being to the north of him; and on the 28th, he passes the fourth, the star being eight minutes from and to the south of him. The Moon passes him on the 5th.

Jupiter is a morning star, at a considerable height above the horizon at sun-rise; being under the nautical star the first of the Lion, and passing the seventeenth of this constellation on the 19th, the star being forty-three minutes and a half south of him. His motion is direct through upwards of five degrees. The Moon passes him on the 19th.

Saturn is on the meridian at twenty-six minutes past six, on the evening of the 1st, and at twenty-three minutes past five, on the 19th. He is under the small stars in the head of the Archer, and his motion is direct through a degree and a half. The Moon passes him on the 3d, and again on the 30th.

Herschell is on the meridian at three minutes past three in the afternoon of the 1st, and every day later; so that, at the end of the month, he is, by his nearness to the Sun and the horizon, at sun-set, discoverable only by the very keen astronomer. He is near the tenth of the Balance, moving slowly towards the eleventh. The Moon passes him on the 26th.

The Sun's apparent diameter is on the 4th, thirty-two minutes five seconds; and on the 13th, thirty-two minutes nine seconds. The apparent diameter of the Moon first increases, then decreases, and, lastly, increases. On the 1st, it is twenty-nine minutes thirty-eight seconds at noon, and it increases till midnight on the 11th, when it is thirty-three minutes four seconds; it then decreases to the 27th, being then twenty-nine minutes twenty-eight seconds; and it increases to the end of the month, being, at noon of the last day, one half of a degree.

The positions of the fixed stars will be known by consulting the volume for 1806 by the following Table.

TABLE OF POSITIONS.

Pos.	1		8		16		25	
	h.	m.	h.	m.	h.	m.	h.	m.
VIII.	7	3	6	38	6	8	5	34
IX.	9	6	8	41	8	11	7	37
X.	11	1	10	36	10	6	9	32
XI.	1	2	0	37	0	7	11	33
XII.	3	8	2	43	2	13	1	39
I.	4	58	4	33	4	3	3	29
II.					6	6	5	32

NOVEMBER, 1813.

THEY, who believe in the doctrine of particles of matter attracting each other, may find sufficient food for reflection in the commonest appearances. The poker, with which they stir the fire, is kept together, according to them, by this principle; but how comes it to pass, that, if the poker is broken in two, the two parts will not adhere together again by any pressure whatsoever? They may be joined by means of fire, or by strong and heavy hammerings, but in both cases it is evident, that the particles of matter near the fracture, when the poker is mended, are much changed in their positions. Two pieces of iron may lie upon each other, for ages of ages, with any weight you please upon them, yet the attractive forces of their particles are unavailing to produce a union. The blacksmith, with his fire and hammer, very easily effects it.

Heat is the great instrument in the union of two pieces of metal, separated from each other and, till we understand its nature, and the mode by which it operates, it should seem, that we ought to be careful how we speak of other causes, which may or may not have an existence. A skilful joiner presents to us a curious inlaid cabinet, in which we cannot discover, but with difficulty, the junction of his woods, they seem to be so closely compacted together. If he were to tell a savage, unacquainted with such works of art, that the different pieces were connected by attraction, the latter might not be able to condradict it; and, not knowing any thing of glue, might be brought over at last to believe it. We, who know how glue is applied, are not surprised at the union of vegetable substances; and though heat seems to operate in a very different manner, if we were as well acquainted with it as with glue, we might, probably, change our language on attraction.

There is an amusing puzzle, which may lead us to think a little more deeply on these subjects. It is made up of small pieces of wood, and is very common among young people. These pieces, when joined together, form a whole, consisting evidently of certain parts; but he who is not in the secret, in vain endeavours to separate them. After many ineffectual trials, he gives up the task; when the more knowing boy, by one easy movement, separates them at once, then joins them again, and defies his companion to a second trial, which is generally as ineffectual as the first. And though the pieces are joined together and separated before him, it is long before he discovers the secret, and probably is indebted, at last, to his companion to shew him the exact process. Here the pieces are so large, that no one would allow that they are kept together by attraction; and why may not metallick substances be so combined together, that they adhere not by attraction, but by the curious interweaving of their parts, which are separated by heat, and by the removal of the heat are gradually brought into a similar situation. I leave this to your adoption or rejection, with that indifference, which belongs to one, who, in explaining a subject, finds that difficulties present themselves to him on every side; yet, encouraged by the example of the barometer, trusts, that what is now so difficult, will, in a future age, be found very easy of solution.

I am not, however, so much interested in this doctrine of particles attracting each other, as is said to be the case in chymical mixtures and solutions; for, supposing the fact to be allowed, difficulties are not removed in the application of it to the heavenly bodies. The Moon is supposed to be two hundred and forty thousand miles off; and it is said to be affected by the mutual attraction of the particles in the Earth and Moon to each other. That particles of water attract sugar, and of metals each other, we might allow; and thus the earth might attract the air nearest to it: but, when we have said all this, what becomes of our attraction, since the air does not extend much above a hundred miles from the earth, and there is a pure space between the globes of Earth and Moon of many thousand miles? Let the efficacy of each particle upon the adjoining one be what it will, what a stretch is it not of imagination, to conceive, that this efficacy extends itself upwards of two hundred thousand miles! The tales told of the poison tree, begin now to lose their credit, yet, with the assistance of the wind, its influence did not extend above twenty miles: whilst, in the case of attraction, we are called upon to believe that the chair on which we are sitting is exerting an influence at the distance of upwards of two hundred thousand miles, and the precise quantity of its influence may be measured.

That the Moon moves round the Earth, is a fact; that its daily approaches to, or recesses from the Earth, may be measured, I allow: and, if its momentary approach is measured, and is owing to the attractive force of the Earth, then the force of the smallest particle in the Earth on the Moon may be measured. Allowing the if, the question is an easy mathematical one; but the whole difficulty lies in the if, which, as is the case of many other ifs, is too easily credited. I do not allow the approach of the Moon to the Earth to be owing to any attractive force existing in either orb; but I may be as wrong as those, who have gone before me, in assigning the cause. Yet I would by no means say, that it is inscrutable.

The Moon is on the meridian on the 1st, at thirty-five minutes past six in the evening, Mars being to the east of her, to whom she is directing her course, evidently to pass him before her next appearance; and at a considerable distance to the west is Saturn, with the small stars in the head of the Archer; the two first stars of the Goat will strike us in carrying the eye from the Moon to Saturn. On the 2d, she is on the meridian at twenty-four minutes past seven, Mars being near her to the west, as she passed him at half past three this afternoon. Near to him, on the west, are the four small stars in the tail of the Goat. Above the Moon are the first of the Water-bearer, and the four small stars in triangle of the Waterpot, the former to the west, the latter to the east of the meridian. On the 3d, she is on the meridian at thirteen minutes past eight; the four small stars in triangle of the Waterpot are now above her to the west; and high above her to the east, are the four stars in square, the two western being near to the meridian, and, consequently, the nautical star, the first of Pegasus, being nearest to the Moon. To the east of her are the small stars in the stream, of which one suffered an occultation last month, but she does not pass them till after moon-set. On the 4th, she is on the meridian at three minutes past nine, having above her, at a considerable distance, the four stars in square, the two western being to the west, and the two eastern to the east of the meridian. On the 5th, she is on the meridian at fifty-four minutes past nine, having now the four stars in square above her, but to the west; and the three first stars of the Ram above her, at a considerable distance to the east of the meridian. On the 6th, she is on the meridian at forty-seven minutes past ten; having, near to her on the west, the thirteenth of the Fishes; as she passed this small star at only ten minutes past ten. Above her, and near to the meridian on the east, are the three first stars of the Ram, of which the first nautical star will be distinguished; and below her, also, to the east, at nearly an equal distance, Menkar, with the small stars in the head of the Whale. On the 7th, she is on the meridian at forty-two minutes past eleven, having near to her on the east the twelfth of the Whale, which she will pass over in her progress. Above her, to the west, are the three first stars of the Ram; and below her, to the east, and nearer to the meridian, Menkar, or the first of the Whale. The occultation of the twelfth does not take place till twenty-nine minutes past midnight, when the star is a minute and forty seconds north of the centre; and it emerges at thirty-eight minutes and a half past one, the star being one minute and twenty seconds south of the centre.

On the 8th is full Moon, at twenty-three minutes past ten in the morning, but without an eclipse, as she is very nearly five degrees south of the ecliptick. In the evening she rises under the three first stars of the Ram and the Pleiades, but nearest to the latter stars; and after rising, in her progress, passes over the small star called *f* of the Bull, which suffers an occultation at fifty-two minutes and a quarter past five, the star being eleven minutes south of the centre; and it emerges at twenty-eight minutes and a quarter past six, the star being twelve minutes and forty seconds south of the centre. She is directing her course through the Hyades, as will be seen to-morrow night. On the 9th, she rises among the Hyades, Aldebaran soon following her, as this star is to the east of her; but she passes him at sixteen minutes past eight; and her progress by this nautical star will be a striking feature of the night. On the 10th, she is followed, soon after her rising, by the sixth of the Bull, or star in the tip of the southern horn, which she passes at six minutes past eight. On the 11th, she rises under the seventh and twelfth of the Twins, being to the east of them; and is seen, during the night, to direct her course to the sixth of the Twins, which she passes before moon-set. On the 12th, she rises under the two first stars of the Twins, and is in a line with them soon after midnight. On the 13th, she passes the ecliptick, about six in the evening, in her ascending node; but, for obvious reasons, without an eclipse. She is, at her rising, near to the fourth of the Crab, as she passes this star at fourteen minutes past nine. To the east of her, at midnight, will be noticed the first of the Lion and Jupiter. On the 14th, she rises in the barren space between the Crab and the Lion; but an interesting groupe will be afterwards formed by her, the first of the Lion, and Jupiter. On the 15th, she rises near midnight, under the first of the Lion, and is soon followed by Jupiter, and her progress by this planet will amuse the traveller during the morning of the 16th.

On the 17th, the Moon rises in the morning under Jupiter, who is at some distance above her. On the 18th, she rises under the second of the Virgin, being soon followed by the seventh; and thus she will be seen within the space formed by the five stars in triangle. On the 19th, she rises under the five stars in triangle of the Virgin; and on the 20th, she rises nearly at the same time with the nautical star the first of the Virgin, which is now to the west of her. On the 22d is new Moon, at fifty-eight minutes past eleven at night; but without an eclipse, as she is four degrees and a half north of the eclip-tick.

On the 24th, the crescent of the Moon is seen, soon after sun-set, near the horizon in the south-west, Venus and Saturn being at a considerable. distance from her to the east. On the 25th, we perceive her directing her course to Saturn, whom she will, evidently, by her course, have approached near to on her next appearance; and the groupe formed this evening by the Moon, Venus, and Saturn, will strike your attention. On the 26th, the Moon is seen near to Saturn at her first appearance, as she passes him at thirty-four minutes past nine; but she does not pass Venus till after moon-set. These three objects form now an interesting appearance. On the 27th, Venus and Saturn are seen to the west of the Moon, the two first stars of the Goat being above her. On the 28th, she is on the meridian at twenty-five minutes past four, the two first stars of the Goat being now above, and Venus and Saturn below her, at a much greater distance, all to the west of the meridian. Mars is to the east of her, at a greater distance than the other planets mentioned. On this day she passes the ecliptick, in her descending node, about noon. On the 29th, she is on the meridian at thirteen minutes past five, being near to the small stars in the tail of the Goat; one of which suffers an occultation. This takes place at a minute and three quarters past six; when the fourth of this constellation touches the eastern rim of the disc, being then ten minutes and a quarter south of the centre; and it emerges at fifty-seven minutes and a half past six, being then eleven minutes south of the centre. Venus and Saturn are now near the horizon, in south-west-by-south; and Mars is at a considerable distance from her to the east of the meridian. On the 30th, she is on the meridian at one minute past six, being under the four stars in triangle of the Waterpot. Mars being now so near to her to the east, that she will evidently pass him before her next appearance.

Mercury is at his greatest elongation on the 24th, being an evening star during the whole month, but with a southern latitude, increasing, for the greater part of it: at first, he is near the Sun, and in the eighth sign; and then, for the last three quarters of the month, in the ninth sign; but his height above the horizon at sun-set is never more than five degrees and a half. This will be sufficient for many astronomers, who have a good south-western aspect and free horizon. The Moon passes him on the 25th.

Venus is an evening star; being on the 1st, at sun-set, between eight and nine degrees above the horizon at sun-set, near south-west-by-south; and this height is continually increasing. From the eighth of the Serpent-bearer, the star near which she passed on the last of the last month, she moves with a direct motion about thirty-six degrees, passing, on the 13th, the eleventh of the Archer, the star being nineteen minutes and a half north of her; and on the 18th, the eighteenth of this constellation, the star being fifty-five minutes south of her. From this time, we shall have ample opportunities of comparing her with Saturn to the east of her, whom she passes on the 24th. On the 22d, she passes the twenty-third of the Archer, the star being twenty-two minutes south of her; and she finishes her course midway in the barren space between this constellation and the Goat. The Moon passes her on the 27th.

Mars is on the meridian at nineteen minutes past seven in the evening of the 1st, and at three quarters past six on the 19th. His motion is direct through eighteen degrees, from a point to the east of the small stars in the tail of the Goat, to one in the stream from the Waterpot, south of the ecliptick. The Moon passes near to him on the afternoon of the 3d; so that we shall distinguish him near to and to the west of her in the evening; and on the 27th, he passes the eleventh of the Water-bearer, the star on the western border of the stream from the Waterpot; the star being forty-seven minutes to the north of him.

Jupiter is a morning star, being on the meridian on the 3d, at eight in the morning, and every morning earlier. He is now under the first of the Lion, and at some distance from this nautical star, receding from a point about a degree from the seventeenth of the Lion, with a direct motion, of about three degrees and a half. The early riser will see him shining very brightly before, and with a pale lustre for some time after sunrise; and at five in the morning, may, with his telescope, contemplate, with great advantage, the position of his moons. Our Moon passes him on the 16th.

Saturn is on the meridian at thirty-seven minutes past four in the afternoon of the 1st, and every day earlier; so that he is daily seen with less advantage. His motion is direct through two degrees and a half, in the barren space between the Archer and the Goat. The Moon passes him on the 26th.

Herschell is in conjunction with the Sun on the 20th, and consequently so near to him, both as an evening and a morning star, as to evade our researches. The Moon passes him on the 22d.

The apparent diameter of the Sun is, on the 1st, thirty-two minutes nineteen seconds; and on the 19th, thirty-two minutes twenty-seven seconds. The apparent diameter of the Moon first increases, then decreases, and lastly increases. On the 1st, at noon, it is thirty minutes twenty-two seconds; and on the 9th, thirty-three minutes twenty-six seconds: it then decreases to midnight on the 23d, when it is twenty-nine minutes twenty-four seconds; and it afterwards increases to the end of the month, finishing with a magnitude of thirty minutes fifty-six seconds.

The places of the fixed stars may be known by consulting the volume for 1806, by the following

TABLE OF POSITIONS.

Pos.	1		8		16		24	
	h.	m.	h.	m.	h.	m.	h.	m.
VIII.	5	6	4	39	4	7		
IX.	7	9	6	42	6	10	5	36
X.	9	4	8	37	8	5	7	31
XI.	11	5	10	38	10	6	9	32
XII.	1	11	0	44	0	12	11	38
I.	3	1	2	34	2	2	1	28
II.	5	4	4	37	4	5	3	31
III.	6	53	6	26	5	54	5	20

DECEMBER, 1813.

I HAVE already mentioned, that the doctrine of the attraction of particles of matter is not necessary to the astronomer. We may leave it to the chymists, from whom, probably, it originated; and though they should bring their minds to the belief of it, it is not necessary that we should follow their example. Because they imagine, from the union of solids and fluids, that particles of matter are endued with an attractive force, by which they hold each other together very closely, we are not to assist the delusion, if it is one, by extending these powers from the distance of a very small part of an inch, to that of thousands of thousands of miles. Astronomy does not require such a sacrifice of our understanding; all its phœnomena may be explained on a different hypothesis; and, if they are not explained, the mind may rest in the situation of

Kepler's, without any great disadvantage to our knowledge.

It was natural, that, after Kepler had made his great discovery of the planets moving not in circular orbits, but in orbits nearly circular, and had laid down his famous law for the proportion between their periodical times and distances, an attempt should be made to explore the cause of these remarkable facts. Newton took up the question, that Kepler had left unsolved, and he laid down a law, by which every thing, at first sight, seems easy of explanation. But, on examining it more closely, we are brought into a dilemma, from which it will not be easy to extricate ourselves. The law of Newton is certain, provided bodies revolve in orbits of the form he lays down; but, if they do not revolve in orbits of such a form, then the law is different, and the conclusions, of course, will vary.

For example, if the planetary bodies are actuated upon by one law of force, then their periodical times and distances will bear a certain proportion to each other, and the curves they describe will be ascertained; in short, they will be what Kepler has asserted them to be; and if the curves are supposed to be what Kepler has described, then the law of the force will be that which Newton has laid down. We come, then, to the enquiry, whether the assertions of the two great philosophers are compatible with each other. Kepler asserts, that the planets move in orbits, which are elliptical, with a certain proportion between their periodical times and mean distances: and Newton asserts, that they are actuated by a force, varying inversely as the square of the distance; as no other force could produce such motions.

Now let us take Newton's opinion first, and suppose, that his force exists in nature; then, how can the planets move in elliptical orbits? For let the Sun, Earth, and Moon, be in any position you please, when the Earth is one point of its orbit, then they will not be in the same position, when the Earth returns to that point. Consequently, they will be acted upon in a different manner from what they were, when the Earth was first in this point; and the curve described by the Earth in the second case, must, therefore, vary from what it was in the first case. This will be true of every point in the Earth's orbit, which, therefore, cannot be elliptical; and no two orbits of the Earth will be for many hundred years, if they ever are, the same. Hence, if Newton's law is true, that of Kepler is false.

Now, let let us suppose, with Kepler, who knew nothing of the forces of which we are talking, that the planets move in elliptical orbits, then each of them would be acted upon necessarily by the force laid down by Newton, provided there was no action of the one upon the other. If they do act each upon the other, then there will be a force at one time added to, and at another subtracted from that of the Sun; and, consequently, since the whole force must follow one law, that of the Sun and the planet cannot follow this law, but their forces must be such as, by combination, to form this law. Hence, if Kepler's law is true, that of Newton is false.

. . . .

We are brought, then, to this conclusion, that the laws laid down by these great men, are neither of them true. The attempt to describe the path of the heavenly bodies is one of noble daring; nor was it less to assign the cause of their motions; but can we imagine, that the unerring hand of Omnipotence is to be thus guided by our arithmetick, by laws of human calculation!

The Moon is on the meridian on the 1st, at forty-eight minutes past six in the evening, being under the four stars in square, the two western being to the west, and the two eastern to the east of the meridian; the former being nearest to it. To the west of her is Mars, at no great distance, as she passed him early in the morning. On the 2d, she is on the meridian at thirty-six minutes past seven, being now under the two eastern of the four stars in square, which are near to the meridian, on the west. On the 3d, she is on the meridian at twenty-six minutes past eight; having, above her to the east, at a considerable distance, the three first stars of the Ram; and to the west, the four stars in square. On the 4th, she is on the meridian at seventeen minutes past nine, being almost directly under the nautical star the first of the Ram, Menkar, with the small stars in the head of the Whale, being below her to the east. At forty-six minutes past ten, she passes the first sixteenth of the Whale. On the 5th, she is on the meridian at twelve minutes past ten, having below her Menkar, to the west, the Pleiades being above her, at a considerable distance, and to the east of it. She is evidently directing her course to the nautical star Aldebaran. On the 6th, she is on the meridian at ten minutes past eleven, having the Hyades near to her on the east, the Pleiades being above her to the west of the meridian. She passes the third of the Bull at eighteen minutes past one in the following morning; the first fourth at fifty-eight minutes past two; the second fourth at twenty-two minutes past three; but she does not reach Aldebaran before moonset.

On the 7th is full Moon, at twenty-five minutes past eight in the evening, but without an eclipse, as she is three degrees and three quarters south of the ecliptick. She rises under Aldebaran, at some distance to the west of her; and she is directing her course under the sixth of the Bull to the thirteenth of the Twins. On the 8th, she rises under the seventh and twelfth of the Twins; and is soon followed by the thirteenth, which suffers an occultation within half an hour after her passage over the meridian; for it takes place at thirty nine minutes and a half past one of the following morning, the star being seven minutes and forty seconds south of the centre; and it ends at thirty-nine minutes and three quarters past two, the star being nine minutes and a half south of the centre. On the

9th, she is followed, soon after her rising, by the fourth of the Twins, which she passes before she sets. On the 10th, she passes the ecliptick, in her ascending node, about an hour before midnight; but, for obvious reasons, without an eclipse. She rises under the two first stars of the Twins, and almost in a direct line with them; and she passes the fourth of the Crab before moon-set; and by her course we shall perceive that she is travelling towards the first of the Lion and Jupiter. On the 11th, she rises in the barren space between the Crab and the Lion; and, as she rises in the heavens, forms, with the first of the Lion and Jupiter, a pleasing groupe. On the 12th, she rises under the first of the Lion, having passed this star at fourteen minutes past six in the evening; and she is soon followed by Jupiter, but she does not pass the planet before sun-rise. On the 13th, she rises under Jupiter, but near to him. On the 14th, she rises with the second of the Virgin, and is perceived, during the morning of the 15th, to be directing her course within the five stars in triangle, not reaching the seventh of the Virgin before moon-set.

On the 16th, the Moon rises in the morning, under the five stars in triangle of the Virgin, near to the third of this constellation. On the 17th, she rises nearly at the same time with the nautical star the first of the Virgin; from which, however, she is at some distance, as her latitude is upwards of five degrees north of the ecliptick. On the 18th, she rises with the tenth and eleventh of the Virgin. On the 19th, she rises nearly with the two first stars of the Balance; and as they rise, she is seen under the line between them. On the 22d is new Moon, at a quarter past seven in the evening, but without an eclipse, as she is then upwards of two degrees and a half north of the ecliptick.

On the 25th, the Moon passes the ecliptick, in her descending node, about nine in the morning; but, for obvious reasons, without an eclipse. In the evening, her crescent is seen between the two first stars of the Goat and Venus, the former to the west, the latter to the east of her. On the 26th, the four small stars in the tail of the Goat are seen between her and Venus, as the planet passed the most eastern of these stars yesterday. The Moon passes the third of the Goat at fifty minutes past seven in the evening, and the fourth at sixteen minutes past eleven; and Venus at three quarters past one of the following morning. On the 27th, she is on the meridian at forty-six minutes past three, being then under the first of the Water-bearer, and the four stars in triangle of the Waterpot, the former to the west, the latter to the east of the meridian. Venus is at some distance below her. On the 28th, she is on the meridian at thirty-two minutes past four, being under the two western of the four stars in square, and having to the east of her the small stars called the twenty-thirds of the Water-bearer, on the western border of the stream, the two first of which suffer an occultation this evening. The first at thirty-one minutes and a quarter past seven in the evening, the star being nine minutes and three quarters north of the centre; and it emerges at twenty-five minutes and three quarters past eight, the star being eight minutes and a half south of the centre. The second suffers an occultation at twenty-seven minutes and a half past eight, the star being eight minutes and three quarters south of the centre; and it emerges at nineteen minutes and a quarter past nine, the star being nine minutes and a half south of the centre. Mars to the east, and Venus to the west of her, will, for some time in the evening, excite our attention. On the 29th, she is in the meridian at nineteen minutes past five, being under the four stars in square; the two eastern stars being near to the meridian, but to the east of it. Mars is still to the east of her. On the 30th, she is on the meridian at six minutes past six, Mars being now to the west of her; having, above her, the four stars in square to the west, and the three first stars of the Ram, at a greater distance to the east of the meridian. On the 31st, she is on the meridian at fifty-four minutes past six; the three first stars of the Ram being above her, and Menkar below her, both to the east of the meridian; but the former much the nearest to it.

Mercury is stationary on the 3d; in his inferior conjunction on the 13th; and stationary again on the 23d. At first he is an evening star, but too near the Sun and the horizon, at sun-set, to be noticed. As a morning star, in the latter part of the month, he presents considerable facilities for observing him, as he is, at sun-rise, on the last day, about thirteen degrees above the horizon; and an hour before sun-rise, is near the south-east, about six degrees above the horizon. Every preceding morning he is, at the same hour, in a less favourable position. The Moon passes him on the 21st.

Venus is an evening star, at her greatest elongation on the 31st. On the 1st, her height above the horizon, at sun-set, is twelve degrees; and this is daily increasing. Her motion is direct through thirty-three degrees, being seen, first under the two first stars of the Goat, and considerably to the west of them; and she directs her course to the small stars in its tail, passing the third on the 23d; the star being fifty minutes south of her; and the fourth, on the 25th, the star being fifty-nine minutes south of her. The Moon passes her nearly on the 27th, at three quarters past one in the morning.

Mars is on the meridian at twenty-one minutes past six in the evening of the 1st, and at three quarters past five on the 19th. His motion is direct through nineteen degrees, from a point between the eleventh and twenty-second of the Water-bearer, but nearest to the former star, and ending nearly in a line with the two eastern of the four stars in square. On the 6th, he passes the twenty-second of the Water-bearer, the star being ten minutes south of him; and, henceforward, travelling in the barren space under the four stars in square, meets with no object worthy of attention. The Moon passes him on the 1st, and again on the 29th.

Jupiter is on the meridian at a quarter past six in the morning of the 1st, and at four on the 19th; as he rises before midnight, he will present himself very favourably for morning observations during this month. He is stationary on the 29th, his motion to that time being direct through about a degree. He is under the body of the Lion, to the west of the twenty-first of this constellation, and about two degrees from it. When on the meridian, he has above him, to the east, the eighth, fourth, and second of the Lion; and to the west, the first and third. The Moon passes him on the 13th.

Saturn is so low in the horizon, at sun-set, at the end of the month, that he ceases to be visible; and consequently, during the whole month, will not much be noticed. His motion is direct through about three degrees in the barren space between the small stars in the head of the Archer, and the two first stars of the Goat, but near to the former stars. The Moon passes him on the 24th.

Herschell is a morning star, too near the Sun at first to be visible; but, at the end of the month, he is nearly fourteen degrees above the horizon at sun-rise. His motion is direct through nearly a degree and three quarters; moving towards the second of the Scorpion, which star he passes on the 30th, the star being fifty-one minutes north of him. Consequently, we have ample directions for discovering him, as soon as he emerges from the power of the Sun's beams. The Moon passes him on the 20th.

The Sun's apparent diameter on the 1st, is thirty-two minutes thirty-one seconds; and on the 21st, thirty-two minutes thirty-five seconds. The apparent diameter of the Moon first increases, then decreases, and afterwards increases. On the 1st, at noon, it is thirty-one minutes ten seconds; and on the 7th, at noon and midnight, thirty-three minutes thirty-two seconds; it decreases to the 21st, being then twenty-nine minutes twenty-six seconds; and it then increases to the end of the month; finishing with a magnitude of thirty-two minutes ten seconds.

The places of the fixed stars will be known by consulting the volume for 1806, according to the following Table of Positions.

TABLE OF POSITIONS.

Pos.	1		8		17		25	
	h.	m.	h.	m.	h.	m.	h.	m.
IX.	5	6	4	36	3	56	3	20
X.	7	1	6	31	5	51	5	15
XI.	9	2	8	32	7	52	7	16
XII.	11	8	10	38	9	58	9	22
I.	0	58	0	28	11	48	11	12
II.	3	1	2	31	1	51	1	15
III.	4	50	4	20	3	40	3	4
IV.	7	11	6	41	6	1	5	25
V.			8	32	7	52	7	16

Another year is now brought to its conclusion; and, on looking back to the origin of this work, and the contents of this volume, I cannot but notice the effects of continued attention to a subject, when the mind is divested of prejudice. When I began this work, I viewed the heavens, as I had been accustomed to consider them, according to the philosophy in which I was instructed, and which I had taught in the university of Cambridge. Some time had elapsed since I held the office of Tutor of a College; in which, had I continued to this time, t is not improbable, that, by going over and over again with my pupils the same principles, I might at this day have agreed with Newton, that some quantities are greater, and others less than nothing, and, with his disciples, that the world is held together by powers inherent in its minute particles. A great philosopher has recommended, that we should, at times, examine our opinions, trace them to their source, explore the foundation on which they rest, how far they are our own, or the opinions of others. This is important advice; and circumstances have been favourable to me in following it; as I have gone over again, with the eyes of circumspection and matured experience, the ground which I trod in my youth; and an attachment to names has not prevented me from pursuing other paths than those prescribed by custom or authority *.

I was amused, by a conversation of some tutors of colleges and masters of arts, not long ago, at Cambridge; in which my opinions were discussed, and my conclusions denied. I smiled to think, that, had I remained in the same place, I might, probably, have joined in the same censure. The Ptolemaick was equally tenacious with the Newtonian school of its own opinions; and Copernicus escaped its persecution by ceasing to live, just as his book was published. We are now grown wiser. We may smile at each others opinions on systems of worlds, and Newton's nothings: but all must go through the ordeal of investigation; and there is no Inquisition to uphold the system of gravity. I was once not aware, that my studies would lead me to the conclusions which this volume contains. As they presented themselves to my mind, the reader has them; it is for him to use them as he

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* Nullius addictus jurare in verba magistri.

pleases, provided he examines them with the same desire to come at truth as the author entertained when he formed them. Should I live to accomplish my intended work, I may have to communicate many other things, occurring in the course of my observations, that do not coincide entirely with received opinions. Every day's experience teaches us, that the wisest have every day something to learn; and they are to be pitied, whether individuals or nations, who are content to tread, over and over again, the same beaten ground; not considering, that to our lower philosophy may be applied what is so beautifully said on a more important subject, by our holy Teacher:—Aim at perfection, for your Father in Heaven is perfect.

THE END.

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